

# EXHIBIT A

Submitted/PI: Melissa A Collins /Proposal No: 2314075

**COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION**

PROGRAM ANNOUNCEMENT/SOLICITATION NO./DUE DATE <b>NSF 22-626</b> 01/11/2023		<input type="checkbox"/> Special Exception to Deadline Date Policy		<b>FOR NSF USE ONLY</b> <b>NSF PROPOSAL NUMBER</b> <b>2314075</b>	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.) <b>DRL - AISL</b>					
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	UEI (Unique Entity Identifier)	FILE LOCATION
01/11/2023	1	11090000 DRL	7259	GS3YEVSS12N6	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) <b>946002123</b>		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)	
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE <b>REGENTS OF THE UNIVERSITY OF CALIFORNIA, THE</b>			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE <b>1608 4TH ST STE 201 BERKELEY, CA 94710-1749 US</b>		
AWARDEE ORGANIZATION CODE (IF KNOWN)					
NAME OF PRIMARY PLACE OF PERF <b>University of California-Berkeley</b>			ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE <b>1608 4TH ST STE 201 BERKELEY, CA 94710-1749 US</b>		
IS AWARDEE ORGANIZATION (Check All That Apply)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS	
					<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT <b>Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes</b>					SHOW LETTER OF INTENT ID IF APPLICABLE
REQUESTED AMOUNT \$ <b>2,149,437</b>	PROPOSED DURATION (1-60 MONTHS) <b>48</b> months	REQUESTED STARTING DATE <b>01/01/2024</b>		SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE	
THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW					
<input checked="" type="checkbox"/> TYPE OF PROPOSAL <b>Research</b>		Human Subjects Assurance Number _____			
<input checked="" type="checkbox"/> COLLABORATIVE STATUS <b>Non-Collaborative</b>		Exemption Subsection _____ or IRB App. Date <b>pending</b>			
<input type="checkbox"/> BEGINNING INVESTIGATOR		<input type="checkbox"/> FUNDING OF INT'L BRANCH CAMPUS OF U.S. IHE			
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES		<input type="checkbox"/> FUNDING OF FOREIGN ORGANIZATION OR FOREIGN INDIVIDUAL			
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION		<input type="checkbox"/> INTERNATIONAL ACTIVITIES: COUNTRY/COUNTRIES INVOLVED _____			
<input type="checkbox"/> HISTORIC PLACES		<input type="checkbox"/> POTENTIAL LIFE SCIENCES DUAL USE RESEARCH OF CONCERN			
<input type="checkbox"/> LIVE VERTEBRATE ANIMALS IACUC App. Date _____		<input type="checkbox"/> OFF-CAMPUS OR OFF-SITE RESEARCH			
PHS Animal Welfare Assurance Number _____					
PI/PD DEPARTMENT <b>The Lawrence Hall of Science</b>		PI/PD POSTAL ADDRESS <b>1 Centennial Drive</b>			
PI/PD FAX NUMBER		<b>Berkeley, CA 94720 US</b>			
NAMES( TYPED)	High Degree	Yr of Degree	Telephone Number	EmailAddress	
PI/PD NAME <b>Melissa A Collins</b>	<b>PhD</b>	<b>2016</b>	<b>510-643-1294</b>	<b>macollins@berkeley.edu</b>	
CO-PI/PD <b>Valeria Romero</b>	<b>MA</b>	<b>2010</b>	<b>510-643-1294</b>	<b>valeriafr@berkeley.edu</b>	
CO-PI/PD <b>Jedda Foreman</b>	<b>MBA</b>	<b>2015</b>	<b>510-642-7504</b>	<b>jforeman@berkeley.edu</b>	
CO-PI/PD					
CO-PI/PD					

**CERTIFICATION PAGE****Certification for Authorized Organizational Representative(or Equivalent)**

By electronically signing and submitting this proposal, the Authorized Organizational Representative(AOR) is:(1)certifying that statements made here in are true and complete to the best of the individual's knowledge; and(2)agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this proposal. Further, the proposer is hereby providing certifications regarding conflict of interest, flood hazard insurance, responsible and ethical conduct of research, organizational support,and safe and inclusive working environments for off-campus or off-site research, as set forth in the NSF Proposal & Award Policies & Procedures Guide(PAPPG).Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense(U.S.Code,Title 18,Section§1001).

**Certification Regarding Conflict of Interest**

The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of PAPPG Chapter IX.A; and that, to the best of the individual's knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization's expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization's conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests module with Research.gov

**Certification Regarding Flood Hazard Insurance**

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF awards for the construction of a building or facility, regardless of the dollar amount of the award; and
- (2) for other NSF awards when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

**Certification Regarding Responsible and Ethical Conduct of Research (RECR)**

**(This Certification applies to proposals submitted prior to July 31, 2023, and is not applicable to proposals for conferences, symposia, and workshops.)**

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Chapter IX.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

**Certification Regarding Responsible and Ethical Conduct of Research (RECR)**

**(This Certification applies to proposals submitted on or after July 31, 2023, and is not applicable to proposals for conferences, symposia, and workshops.)**

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies and Procedures Guide, Chapter IX.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate students, graduate students, postdoctoral researchers, faculty, and other senior personnel who will be supported by NSF to conduct research. As required by Section 7009 of the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act (42 USC 1862o-1), as amended, the training addresses mentor training and mentorship. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

**Certification Regarding Organizational Support**

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

**Certification Regarding Dual Use Research of Concern**

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

**Certification Requirement Specified in the William M.(Mac)Thornberry National Defense Authorization Act for Fiscal Year 2021, Section 223(a)(1) (42 USC 6605(a)(1))**

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that each individual employed by the organization and identified on the proposal as senior personnel has been made aware of the certification requirements identified in the William M.( Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, Section 223(a)(1) (42 USC 6605(a)(1)).

**Certification Regarding Safe and Inclusive Working Environments for Off-Campus or Off-Site Research**

(This certification applies only to proposals in which data/information/samples are being collected off-campus or off-site, such as fieldwork and research activities on vessels and aircraft.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies and Procedures Guide, Chapter II.E.9, the organization has a plan in place **for this proposal** regarding safe and inclusive working environments.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME <b>Mary Bonvillain</b>		<b>Electronic Signature</b>	<b>Jan 11 2023 12:24 PM</b>
TELEPHONE NUMBER <b>510-643-5603</b>	EMAIL ADDRESS <b>mary.bonvillain@berkeley.edu</b>	FAX NUMBER	

**Overview.**

The Lawrence Hall of Science at the University of California, Berkeley proposes a four-year *Integrating Research and Practice* project to the National Science Foundation's Advancing Informal Science Learning (NSF 22-626) program that will better position informal learning institutions to understand impact by producing a set of science and environmental literacy measures that center the knowledge, expertise, and experience of communities of color. Scientific and environmental literacy are valuable outcomes linked to academic learning, STEM career pathways, and broader engagement in science and environmental causes and advocacy. However, the current tools for measuring these concepts are insufficient; though useful for measuring some dimensions of impact, they are aligned with dominant views that exclude and erase the knowledge and expertise of communities of color. We plan to improve existing measurement tools as well as design new ones by engaging in a community-driven process that will center the voices of communities of color. We will then use these tools to measure the impact of outdoor science and environmental learning (OSEL) experiences on students' scientific and environmental literacy. In Phase 1, we will form a Community Research Network (CRN) composed of youth, educators, leadership, and community members of partnering OSEL organizations. In collaboration with the CRN, we will engage in an iterative process of idea generation, data collection, and sensemaking to articulate and co-develop a set of revised and new outcome measures. In Phase 2, we will validate these measures through a quantitative study that will paint a fuller picture of the impact of OSEL experiences on youth, while also seeking to understand how youth of color make meaning of these experiences through a focal student case study approach. Finally, in Phase 3, we will collaborate with the CRN to share findings with the field, including through a conceptual framework that articulates the outcomes and structures within and adjacent to OSEL organizations that allow for youth to thrive.

**Broader Impacts.**

The OSEL field is in an intense period of rebuilding after impacts from the COVID-19 pandemic, presenting an opportunity to have a transformative impact on the field, with a long-term impact on STEM education writ large. Within this context, this project is positioned to have a significant impact on research and praxis in the OSEL field, formal and informal education practice, and in broader society. This project is built on the premise that both research and praxis in OSEL have reinforced the oppression and marginalization of people of color; through our community-driven approach and our creation of new community-driven measures, this project will push researchers and practitioners to grapple with what it means to move towards more just and equitable practices in research and practice. This project will generate refined definitions of OSEL outcomes that center the voices and experiences of youth and communities of color and will develop a conceptual framework articulating the relationship between these outcomes and the structures within and adjacent to OSEL organizations that allow for youth of color to thrive. These contributions will build upon ongoing scholarship on how to improve science and environmental literacy, positioning youth for STEM pathways and environmental activism and cultivating the next generation of STEM and environmental leaders. By bringing broader representation to the STEM field, with greater diversity of lived experiences and perspectives, this project will support new ideas and innovation to solve persisting societal challenges not resolved by the status quo. In addition, this project will also contribute new insights on engaging in community-driven, participatory research that can contribute to the field's understanding of how to enact just and equitable mixed methods research.

**Intellectual Merit.**

This study will contribute new perspectives on how race and culture influence learning, as well as how racism and biases have shaped research and practice to date. This project will produce a suite of psychometrically tested tools that are driven by communities of color, improving the field's ability to measure learning while also taking one step to counteract a long history of marginalization in research. The work will contribute to existing bodies of literature on the benefits of outdoor learning and the role OSEL experiences can play in developing science and environmental literacy, while also contributing new knowledge on how to redefine these outcomes and redesign studies to be more equitable.

## TABLE OF CONTENTS

For font size and page formatting specifications, see PAPPG section II.B.2.

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	<u>1</u>	<u>          </u>
Table of Contents	<u>1</u>	<u>          </u>
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) <b>(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	<u>15</u>	<u>          </u>
References Cited	<u>6</u>	<u>          </u>
Biographical Sketches (Not to exceed 3 pages each)	<u>9</u>	<u>          </u>
Budget (Plus up to 5 pages of budget justification. For proposals that contain subaward(s), each subaward must include a separate budget justification of no more than 5 pages)	<u>10</u>	<u>          </u>
Current and Pending Support	<u>24</u>	<u>          </u>
Facilities, Equipment and Other Resources	<u>2</u>	<u>          </u>
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	<u>12</u>	<u>          </u>
Appendix (List below. ) <b>(Include only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	<u>          </u>	<u>          </u>
Appendix Items:		

\*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

## Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes

Melissa Collins, Valeria Fike Romero, and Jedda Foreman

### Introduction

The Lawrence Hall of Science at the University of California, Berkeley proposes a four-year *Integrating Research and Practice* project to the National Science Foundation's Advancing Informal Science Learning (NSF 22-626) program that will better position informal learning institutions to understand and measure impact by identifying and defining a set of science and environmental literacy outcomes and measures that center the knowledge, expertise, and experience of communities of color. Environmental and scientific literacy are valuable constructs linked to academic learning, STEM career pathways, and broader engagement in science and environmental causes and advocacy. However, the current tools for understanding and measuring these concepts are insufficient. Though useful for measuring some dimensions of impact, they are aligned with dominant views that most often exclude and erase the knowledge and expertise of communities of color.

We plan to improve existing measurement tools as well as design new ones by engaging in a community-driven process that will center the voices of communities of color, namely Black, Latinx, and Indigenous communities. We will then use these tools to measure the impact of outdoor science and environmental learning experiences on students' scientific and environmental literacy. In Phase 1, we will form a Community Research Network (CRN) composed of youth, educators, leadership, and community members of partnering outdoor science and environmental learning organizations. In collaboration with the CRN, we will engage in an iterative process of idea generation, data collection, and sensemaking to articulate and co-define a set of revised and new outcomes. In Phase 2, we will validate these measures through a large, quantitative study that will paint a fuller picture of the impact of outdoor science and environmental learning experiences on youth, while also seeking to understand how youth of color make meaning of these experiences through a focal student case study approach. Finally, in Phase 3, we will collaborate with Phase 1 participants to share findings and discuss implications for the field, resulting in a proposed conceptual framework that explores the relationship of these outcomes to structures within and adjacent to outdoor science organizations. This work, we argue, will provide conceptual and methodological underpinnings that allow us to more fully understand the myriad of ways that youth of color thrive (e.g., grow, learn, feel valued and successful) in outdoor science and environmental learning experiences.

### Project Rationale

Outdoor Science and Environmental Learning (OSEL) organizations are a critical component of the STEM ecosystem (Ardoin & Bowers, 2020; Ardoin et al., 2018), particularly in advancing science and environmental literacy—outcomes that are of increasing importance given the increasingly dire impacts of climate change (California Department of Education, 2015). Over the past decade, national and statewide recognition of the importance of environmental learning, in particular, has elevated the critical role the OSEL field can play in supporting science teaching and learning in the context of the Next Generation Science Standards (NGSS). OSEL refers to programs that provide outdoor-based science learning experiences and can include residential overnight programs, community-based programs, and nature centers. Science learning can include multiple topics, including local ecosystems, environmental justice, community issues, and climate change. In the U.S., young people often encounter OSEL programs at grades 4-8, a critical point in their educational pathways. It is the time at which U.S. performance (and absolute interest in science) compared to other countries begins to drop (Gonzales et al., 2008). Interest and engagement in science by grade eight is an important predictor of whether students will continue their education in science beyond high school (Tai et al., 2006). Cultivating scientific and environmental dispositions can also promote an interest in understanding broader scientific and environmental issues that can support lifelong decision-making and advocacy (Hollweg et al., 2011; Yacoubian, 2018). Learners often report how different and motivating time spent at an OSEL organization is compared with traditional classroom settings. Teachers report they cannot otherwise provide these in-depth and out-of-classroom experiences, and that OSEL are even "transformative" for individual students and/or entire classes (Crompton



& Sellar, 1981; Tal et al., 2019). Research has documented that OSEL experiences can have positive effects on cognitive, social-emotional, behavioral, and academic outcomes. For instance, outdoor learning can support student engagement and interest in learning (Coyle, 2010; Kuo et al., 2018); confidence, leadership, and motivation (McLeod & Allen-Craig, 2007); and improved content learning and retention (Avci & Gümüş, 2020; Carrier, 2009; Fančovičová & Prokop, 2011; Peacock et al., 2021). Collectively these bodies of work continue to amplify that outdoor science programs can play an important role in supporting scientific and environmental learning. While some scholarship has demonstrated the value and effectiveness of outdoor learning, there has been less research that has explicitly focused on the impact of OSEL programs. Further, we argue that outcomes have largely been defined and shaped by White, Eurocentric, male epistemological framings, and therefore have neglected the historical context of the field. To this end, it is imperative we center the expertise and experiences of communities of color in our conceptualization and measurement of outcomes.

## Racial Context of the OSEL Field

Scholars and practitioners have raised important empirical questions about how race shapes the design and enactment of learning environments, and subsequently how that impacts youth of color. Mainstream OSEL experiences are most often aligned with the values of White, male, middle-class culture (Lewis & James, 1995; McLean, 2013), obscuring the sociocultural histories of communities of color, rendering their experiences invisible and serving as a barrier to building meaningful relationships with those communities (Finney, 2014; Warren, 2016). Conceptions such as the highly-influential notion of nature deficit disorder (Louv, 2005) privilege the perspective of White heteronormative patriarchal values and assumptions (e.g., by privileging ways of being in nature that are derived largely from the experience of White, middle-class boys, such as building tree houses and forts) and continue to dominate practices and priorities in the field. In this way, these conceptions limit who engages with, or even relates to, the goals of mainstream environmental learning (Nxumalo & Cedillo, 2017). By prescribing how people should encounter and be affected by nature, the dominant White narrative limits the capacity of the OSEL field to consider more inclusive imaginings of diverse and culturally-relevant learning experiences. Additionally, OSEL is situated within a history where settler colonialists seized the land of Indigenous peoples (Voyles, 2015) that led to their removal and the violent erasure of the cultural practices of many communities of color (Tuck et al., 2014). Indigenous and Black communities were targeted for the forced acquisition of land in service of creating regional, state parks, and national parks (TREC, 2021). This has had ripple effects in the establishment and evolution of the OSEL field— shaping which ways of knowing (epistemology) and being (ontology) are uplifted and valued in these spaces. Together, this history has resulted in a mainstream OSEL field that does not understand the needs of communities of color, which is mirrored in the conceptualization of scientific and environmental literacy.

## Environmental and Scientific Literacy

In the U.S. and globally, scientific and environmental literacy have been elevated to critical importance to support and deepen our understanding of the environment, the land, and the people, and how science can be used as a tool to mitigate the negative impacts of climate change. Schools and informal learning spaces, like outdoor science and environmental learning organizations, are seen as mechanisms for fostering students' understanding of scientific and environmental concepts, inquiry, and meaning making (Bybee, 1995). Therefore, the definition of scientific and environmental literacy has consequential impacts for the enactment of science and environmental learning.

Since the early 1900s researchers and practitioners have grappled with what scientific and environmental literacy mean. For instance, scientific literacy has been referred to as the cognitive knowledge and skills connected to how one makes use of science information for improvement and social good (Hurd, 1997) that can support innovation and civic engagement (DeBoer, 2000). Scholars that have examined the conceptualization of scientific literacy have identified three overarching visions—Vision 1 emphasizes gaining knowledge of the scientific process and content as a means towards understanding the virtue of science; Vision 2 focuses on scientific practices and the process of science as a means towards seeing the relevance and utility of science; and Vision 3 extends scientific literacy to gain skills and knowledge that position learners to critique the canon of science and develop a sociopolitical consciousness (Roberts, 2007; Yacoubian, 2018; Yore, 2012).

Similarly, since the 1960s, environmental literacy has been deeply tied to and has shaped the environmental conservation movement with its focus on an ecological paradigm (Roth, 1992). Roth notes that in many ways environmental literacy is connected to scientific literacy through a focus on the development of scientific habits of mind (e.g., critical thinking, seeking and organizing information) but in addition there is a concern with understanding how environmental issues and the world have come to be (Roth, 1992). Environmental literacy refers to the “knowledge of environmental concepts and issues; the attitudinal dispositions, motivation, cognitive abilities, and skills, and the confidence and appropriate behaviors to apply such knowledge in order to make effective decisions in a range of environmental contexts” (Hollweg et al., 2011, pp. 15-16), and includes indicators like conceptual knowledge, problem-solving and critical thinking skills, and positive dispositions, attitudes, and action related to the natural world and the environment (Wheaton et al., 2018).

While these notions of scientific and environmental literacy can create great opportunities for learning and supporting young people to be empowered to address scientific and environmental issues in their communities, there is a concern about the ways in which the conceptualization, and subsequently the measurement of these constructs, can neglect the epistemic and ontological practices that youth, particularly youth of color, bring to learning environments. For instance, a recent systematic review of outdoor learning outcomes (Mann et al., 2022) did not once mention cultural relevance or race. Gibson et al. (2022) notes that “the historical roots of environmental literacy are grounded in the Tbilisi Declaration, which defined the outcomes for environmental education as awareness, knowledge, and attitudes about the environment, including skills and participation to solve environmental problems for both individuals and social groups” (UNESCO 1978 as cited in Gibson et al., 2022, p. 1424), and yet environmental literacy is often measured at an individual level. In addition, scholars have noted that what counts as scientific discourse can position students with higher status (Brown, 2004) and thus reify the stratification of knowledge (Anyon, 1981).

What these scholars elevate is that scientific and environmental literacy constructs and measures do not fully account for the racialized experiences of youth of color (Nxumalo, 2021; Pérez and Saavedra, 2017). Further, there is a risk of said constructs and measures reinforcing damage-centered narratives (Tuck, 2009) or narratives that uphold oppressive and racist ideologies of the relationship between communities of color and the environment. Therefore, there is a need to center the knowledge and expertise of youth of color in the conceptualization of these constructs so that we can better understand the experiences of youth, namely youth of color in science and environmental learning environments. As stated by the Learning in Places collaborative (2021), “all communities engage in scientific sensemaking of the natural world, but they may not say it’s science” (p. 5). Thus, the OSEL field is in need of ways to more expansively understand how youth and communities of color engage in science and environmental learning and meaning making.

## Building on Prior Work

The proposed project builds on prior work by the PI team, who were key personnel on an NSF-funded project (NSF DRL 1612512, *Broad Implementation of the Better Environmental Education, Teaching, Learning, and Expertise Sharing Professional Learning Model for Outdoor Science Programs* [Strang & Dorph]) to measure the impact of OSEL experiences on youths’ dispositions toward science and the environment. Working with a network of outdoor science programs whose leadership participated in a capacity-building program (also funded through the same grant), the study sought to understand the extent to which these programs supported positive dispositions toward science and the environment for participating youth, as well as whether there were any differences in effects by race/ethnicity or gender. The study found not only that these programs did support positive shifts in dispositions, but also that the effects were greater for youth of color than for their White-identifying peers. The study provided compelling evidence that outdoor science programs may have a disproportionate impact on youth of color, but also relied on status-quo definitions of success in learning environments. The present study builds upon this prior work by seeking to develop and/or refine a new suite of metrics for measuring scientific and environmental literacy that are community-driven and co-developed, thereby redefining success in ways that better characterize and capture the priorities of communities of color.

This study will also build upon the PI team’s previous work with the Activation Lab, which offers a theoretical framework, *Science Learning Activation*, that articulates a set of knowledge, dispositions, and skills that position



youth for success in proximal (near-term) and potential distal (long-term) STEM learning experiences (Dorph et al., 2016). The Activation Framework proposes that, when youth have successful experiences in science learning, which includes informal learning contexts such as OSEL, they generate more positive dispositions, resulting in a positive feedback loop that propels learners on pathways towards longer term outcomes such as scientific literacy and persistent participation in science. The present study builds upon this idea that knowledge, dispositions, and skills can position students for success, while also recognizing that these scales were developed using traditional, quantitative/psychometric approaches, and that there are inherent tensions between primarily quantitative approaches and understanding the complexities of being a person of color in White-dominant spaces (Godwin, 2020; Sablan, 2019). Therefore, while the present work is informed by and may draw from existing scales from the Activation Lab, the final outcomes and scales will be developed through a community-driven approach.

## Broader Impacts

Currently, the OSEL field is in an intense period of rebuilding after impacts from the COVID-19 pandemic (Collins et al., 2020), and racial equity is the most commonly named priority by organization leaders (Collins et al., 2021). At this critical moment, it is possible to have a significant, transformative impact on the field, with a long-term impact on the greater STEM education field, given the interchange of educators and ideas, and the growing recognition by K-12 schools of the importance of OSEL experiences (Becker et al., 2017). Therefore, we see this project as being positioned to have a transformative impact on research and praxis in the OSEL field, formal and informal education practice, and in broader society.

This project will generate refined definitions of OSEL outcomes that center the voices and experiences of youth and communities of color. This will lead to the development of a conceptual framework that will articulate the relationship between outcomes and the structures within and adjacent to OSEL organizations that allow for youth of color to thrive. In this way, findings will contribute to the field's understanding of youth of color's experiences in OSEL using culturally relevant and meaningful constructs and measures. The study will contribute to building bodies of scholarship that provide evidence on how to improve science and environmental literacy, positioning youth for STEM pathways and environmental activism and cultivating the next generation of STEM and environmental leaders. By bringing broader representation to the STEM field, with greater diversity of lived experiences and perspectives, this project will support new ideas and innovation to solve persisting challenges not resolved by the status quo.

In addition, this project will also contribute to new insights in engaging in community-driven, participatory research. This project is built on the premise that both research and praxis in OSEL have reinforced the oppression and marginalization of people of color; thus pushing researchers, scholars and practitioners to grapple with what it means to move towards more just and equitable practices. This project will explore what it takes to integrate community-driven, participatory approaches in the conceptualization of scientific and environmental literacy and associated outcomes, as well as in the development of measures that will be used at multiple levels of scale. In this way, we will document effective practices and approaches that can contribute to the field's understanding of how to enact just and equitable mixed methods research in the context of OSEL.

## Guiding Frameworks: Centering the Racialized Experiences of Youth of Color

One of the underlying premises of this project is that, in order to more fully understand the experiences of youth in OSEL environments, we must center the racialized experiences of youth of color that have been historically ignored. Therefore, we draw on critical race theory (CRT) and the Family and Community Framework for Engagement and Collaboration. Collectively, these frameworks attend to how race shapes the experiences of youth of color in OSEL learning environments, and elevates the "forms of expertise and ways of knowing about the natural world of learners' cultural communities" (Learning in Places, 2021, p. 1). Here we describe each of these frameworks and how they will inform our work.

**Critical Race Theory** is a framework that stemmed out of the legal field in response to the recognition that embedded structures, policies, and laws perpetuate racism and oppression of Black, Indigenous, and people of color in the U.S. (Bell, 1992; Crenshaw et al., 1995; Ford, 1994; Harris, 1993; Matsuda, 1987; Peller, 1990).

One of the underlying premises of CRT is that structures exist and function to protect Whiteness as property, which is based on the idea that “Whiteness remains a concept based on relations of power, a social construct predicated on White dominance and Black subordination” (Harris, 1993, p. 1761). Within education, Ladson-Billings (1998) describes school curriculum as a master script designed to maintain Whiteness, wherein there are implicit and explicit values and ideologies that serve as the basis for the narratives and content included, and consequently silences multiple voices and perspectives (Ladson-Billings, 1998). In the context of this study, therefore, we aim to explore the ways in which notions of scientific and environmental literacy uphold Whiteness, as a means to reconceptualizing these very constructs that shape OSEL learning environments. Another key tenet of CRT is counterstories, where there is an intent to elevate the experiences and narratives of people of color to disrupt dominant oppressive narratives. In this study, we aim to center the knowledge and expertise of youth, and communities, of color in our conceptualization and measurement of scientific and environmental literacy to re-center narratives to amplify the voices and lived experiences of BIPOC people and communities (Delgado Bernal, 2002; Delgado & Stefancic, 2017), and potentially produce counterstories of the ways in which youth of color experience learning in OSEL programs. A third tenet of CRT is intersectionality (Crenshaw, 1991; Collins, 2000) who argue that intersecting systems of oppression like race, class, gender have compounding and nuanced impacts on groups, namely Black women and girls, based on their social location and identities. In this study, while we focus on understanding the experiences of youth of color, we also recognize the nuanced ways intersecting systems of oppression shape the experiences of youth. In the field of OSEL, there is a call for scholars to draw on intersectionality given the ways race, class, and gender have historically shaped youth experiences in these spaces (Maina-Okori et al., 2018). To this end, we have partnered with organizations who bring a racial justice lens and perspectives that are grounded in the racial diversity of their communities to ensure that we are not essentializing the experiences of youth of color.

**Family and Community Framework for Engagement and Collaboration** is a learning framework that aims to connect and uplift “the knowledge and practices of diverse families to learning, [which] enables learners to recognize themselves and their families as doing science, and disrupts the ways in which science is often inaccurately portrayed as primarily emerging from western intellectual traditions” (Learning in Places, 2021, p. 1). While this framework is primarily designed for educators, educational leaders, families and communities to inform partnership approaches and educational praxis, we hold that this framework provides an equally important lens for research design and development. Within this project, we aim to uplift youth and community voices and experiences in our understanding, articulation, and measurement of scientific and environmental literacy. To this end, we recognize that, in defining scientific and environmental learning outcomes, we must attend to the varied and expansive ways youth and communities engage in scientific sense-making (complex socio-ecological systems); the intergenerational and communal practices youth and families engage in (culture, families, and communities); and the localized and culturally-specific ways youth and families engage in learning and scientific and environmental practices (field-based science learning). Further, we must recognize how understandings of youth experiences and learning outcomes are situated in broader ideologies about nature-culture relations and shaped by structures of race, class, gender, and power. Therefore, we will draw on this framework as a heuristic to engage in critical reflection about the assumptions that undergird understandings of scientific and environmental literacy and how these assumptions shape what knowledge, practices, and dispositions are seen as important in this context. In addition, we will draw on the framework as a methodological tool to guide how we engage community members, in what ways, and at what time points, to support goals of centering youth and community voice.

## Project Design

The proposed research project has two primary goals. First, we seek to better understand the value of OSEL programs for youth (and particularly youth of color) related to science and environmental literacy through the development of intentionally designed and rigorously validated research metrics to measure community-driven, culturally relevant outcomes. The second goal of this project is to understand how to design and engage in research that centers and uplifts the knowledge of youth of color and those that work within outdoor science programs, working to expand paradigms of research in outdoor science programs and bridging research to practice. To work toward Goal #1, we have four research questions (RQs) across two phases of work, as summarized below in Table 1. The evaluation (described in the Evaluation Plan section) will address Goal #2.

Table 1. Research Questions and Methods by Phase

Research Questions		Methods
Phase 1 - Defining Outcomes	<p>(1) What do scientific literacy and environmental literacy mean to communities of color?</p> <p>(2) What outcomes are most meaningful for youth of color who engage in outdoor science learning experiences, and how can they be measured?</p>	<ul style="list-style-type: none"> <li>• Establish Community Research Network (CRN)</li> <li>• Facilitate focus groups and interviews with youth, parents, educators, staff, and/or community members at partner organizations</li> <li>• Develop and pilot student survey and organizational leadership survey</li> </ul> <p>Sample: youth, educators, leadership, and community members from 3 partner organizations</p>
Phase 2 - Measuring Impact	<p>(3) In what ways do OSEL programs influence scientific and environmental outcomes for youth, particularly youth of color?</p> <p>(4) How do youth of color make meaning of these experiences?</p>	<ul style="list-style-type: none"> <li>• Student surveys</li> <li>• Organizational leadership Survey</li> <li>• Youth focus groups (case sites)</li> <li>• Educator interviews (case sites)</li> </ul> <p>Sample: youth and educators from 20-30 OSEL organizations across the U.S., plus 3 case sites</p>

*Methodological Approach: Community Based Participatory Research*

Our approach to research aims to cultivate a community-driven approach, in which OSEL community members are authentically and meaningfully informing the design and execution of the study, and engage in sensemaking of findings and collaborative dissemination of findings to the field. To achieve these goals, we will draw on Community Based Participatory Research, a methodological approach that first emerged in the field of public health to respond to the ways in which environmental and public health research often excluded communities in their understanding of how environmental issues were impacting the everyday experiences and lives of peoples (Cornwall & Jewkes, 1995; Israel et al., 2012). Therefore, CBPR aims to engage communities, organizational representatives, and researchers in collaborative research to generate knowledge of phenomena and advocate for social and policy change based on that knowledge (Israel et al., 2012). Israel and colleagues note that CBPR has emerged in multiple disciplines including in education, and may also be referred to as participatory action research, among other labels. Further, Cornwall & Jewkes (1995) note that participatory research can take on many forms that can shape degrees of participation and engagement over time. With that said, Israel et al. (2012) describe nine guiding principles to support the enactment of CBPR efforts: (1) Community is a unit of identity that is socially created and recreated; (2) Communities hold strengths, resources and assets that must be recognized and built upon; (3) Research must attend to social inequalities and facilitate an equitable, power-sharing partnership; (4) Research is a co-learning process that fosters reciprocity; (5) There must be attention to both research and practice in ways that benefit all partners; (6) Foci must be relevant to communities and attend to the specific context of communities; (7) Processes are cyclical and interactive; (8) Dissemination should be led by all partners (e.g., co-author partnerships) and findings must be disseminated to all impacted and involved communities and partners; (9) The process must attend to long-term sustainability (that is co-determined).

In this research, we will draw on the practices of CBPR to guide the research process. One limitation we acknowledge is that CBPR often calls for research questions to be co-constructed— that is, questions emerge from the community. This study, including our empirical questions, builds on prior partnerships and work in OSEL, and therefore we hold that our study is putting forward theoretical questions that are meaningful and relevant to OSEL programs, youth, and broader communities. While we will not co-generate research questions, we will draw on the guiding principles of CBPR to inform the study design. One central feature of this design is the development of a Community Research Network, which will comprise our three organizational partners (NatureBridge, Yes Nature to Neighborhoods, and Wabanaki Youth in Science), that will authentically engage

in both phases of the research described below. To guide our planning and approach, we will engage with Coalition of Communities of Color (CCC), a non-profit racial and data justice organization that supports organizations in thinking about how to center race and community-driven research practices. In what follows we describe our study design, and recognize that within the boundaries of our empirical questions and goals, specific methods may evolve in response to our community partners.

### *Study Overview*

This project will employ a participatory, mixed methods approach across two phases. In Phase 1, we will conduct a qualitative study with participatory elements to articulate key science and environmental literacy outcomes for youth of color participating in outdoor science programs. After identifying the outcomes to focus on, we will co-develop research instruments to measure these outcomes, and will conduct a series of cognitive interviews and a pilot study to refine the instruments, with a particular focus on the survey. Products from Phase 1 will include a preliminary conceptual framework of science and environmental literacy outcomes for youth of color who participate in outdoor science programs, as well as a suite of culturally relevant scales. In Phase 2, we will conduct a mixed methods study to measure the extent to which outdoor science programs support positive changes in participating youths' science and environmental literacy outcomes. The center of the Phase 2 study will be a large, quantitative study using the survey instrument developed in Phase 1. The survey data will be complemented by qualitative interviews to provide context to the quantitative data. Quantitative data analysis will examine the extent to which outdoor science programs promote positive changes in science and environmental literacy outcomes for youth of color, while qualitative data analysis will examine the conditions within and surrounding outdoor science programs that create the environment for youth of color to thrive.

*Phase 1* (Years 1-2) will be a qualitative, participatory design-based study conducted in close collaboration with our Community Research Network and Project Advisory Council. In this phase, we aim to (1a) develop a conceptual understanding of key outcomes and indicators of science and environmental learning, and (1b) develop and pilot research instruments to measure outcomes. In this phase, we will facilitate a series of focus groups and semi-structured interviews to explore youth and community perspectives and experiences related to science and environmental learning to identify and/or refine key indicators of environmental and scientific literacy (e.g., practices, knowledge, dispositions). The process will involve iterative cycles of idea generation, data collection, and sensemaking, with the goal of arriving at a set of mutually agreed upon science and environmental literacy outcomes for youth of color who participate in outdoor science programs. Based on these outcomes, we will create and pilot a survey and additional research tools to be used in Phase 2. This development process will be informed by evidence-centered assessment design (Mislevy & Riconscente, 2005), with activities such as domain analysis and modeling to articulate the key concepts within each outcome; development of a conceptual framework to articulate a blueprint for item generation; and finally, implementation of draft items and scales, which will be used in a series of cognitive interviews and subsequent pilot study. Each step of the process will include member checking with the CRN.

**Participants** This project will be shaped by the expertise, perspectives, and priorities of our partner organizations: Yes Nature to Neighborhoods, NatureBridge, and Wabanaki Youth in Science. These organizations, described in more detail in the Project Management section, have been selected because they serve a racially diverse group of learners, including Latinx, Black, and Indigenous youth. One organizational leader of color from each organization will hold a leadership position on the project, including participating on the Advisory Council. These organizational leaders will also assemble 4-6 additional stakeholders (e.g., educators, alumni, family or community members) from their organizations to form the **Community Research Network (CRN)**. The 16-20 individuals on the Community Research Network will play a pivotal role in ground-truthing to steer conceptual development and study design and collaborating to co-design the research plan, co-define constructs, and co-develop research protocols. Partner organizations will also serve as the data collection sites for Phase 1.

**Instruments, Procedures, and Analysis - Phase 1** Phase 1 will occur in two parts: *Phase 1a* will engage partner organizations to identify and/or refine indicators and outcomes and develop research tools, including a



survey instrument and scales; Phase 1b will focus on refining the survey design, and other research tools, through cognitive interviews, followed by a quantitative pilot study.

*Phase 1a - Idea Generation and Iterative Cycles of Data Collection, Sensemaking, and Instrument Development (Year 1).* This phase will be guided by an iterative process that will be co-designed by CRN and Lawrence teams. Throughout the process, the CCC team will be a thought partner to support a study design and process that centers racial justice and community-driven practices. In this way, methods and approaches to how we explore and make sense of community experiences and perspectives related to science and environmental learning may shift and evolve over the course of this phase. With that said, we provide an example of what this process might look like for illustrative purposes. Over the course of Year 1, the CRN and Lawrence teams will meet four times. At the onset of this phase (Meeting #1), the CRN and Lawrence teams will meet to review project goals, research questions and co-develop methods and tools. In this process, we will consider questions like: what do we already know (from research and praxis); how can we elevate the voices of those most marginalized, including youth of color; how can we minimize burden and potential harm? This work will lead to the data collection phase, wherein we will conduct a series of focus groups to explore what indicators and outcomes youth and OSEL community members perceive as meaningful. Following focus groups, the Lawrence team will conduct a preliminary analysis of data and then facilitate a collective sensemaking session (Meeting #2) with the CRN to identify themes, which will include discussing implications for our constructs. This will lead to the development of refined constructs. In collaboration with the CRN, we will then explore how to measure these constructs in a survey and other research methods, such as observations and interviews (Meeting #3). The Lawrence team will take the lead on developing instruments, which then we will engage the CRN in a comprehensive review and feedback of protocols and processes for piloting instruments, such as a sampling plan for pilot survey administration (Meeting #4).

*Analysis - Phase 1a.* Analysis of Phase 1 data will occur in a phased approach. First, we will conduct thematic analysis of CRN meeting notes and focus group transcripts to compile key themes and constructs that will be used to inform conversations with the CRN and support the development of a draft student survey. Thematic coding will begin inductively, using a “bottom-up” approach to compile themes from the data; we will then proceed to a second round of coding, this time using a deductive approach, using the themes from inductive coding, to identify different manifestations of similar themes across conversations and data sources (Xu & Zammit, 2020). Analyses will also attend to patterns of overlap and divergence in themes based on individuals’ racial/ethnic identities and other lived experiences.

*Phase 1b - Pilot Study, Sensemaking, and Scale Finalization (Year 2).* In this phase, we will pilot research tools with youth and educators, while continuing to actively engage CCC to support integration of racial justice and community-driven practices and approaches. To finalize the pilot survey, we will conduct cognitive lab interviews with youth and educators to ensure questions are clear and relevant. These interviews with participants at the partner organizations will occur iteratively to check for clarity and identify problematic items needing revision. The process will involve interviews where researchers sit with the youth as they complete the instrument (Ericsson & Simon, 1993). Throughout the cognitive lab, the researcher asks the student to articulate the questions in their own words and explain why they have chosen their answer. Researchers then review notes/transcripts across interviews to verify the clarity of the items, understand the uniqueness of interpretation, and determine if there are discrepancies between the item and the response options or if there is evidence of bias or sensitivity. The goal of this process is to establish a link between the outcome of interest, the observed response, and the interpretation of that response for each question (Leighton, 2004). Following each round of cognitive interviews, we will invite the CRN to review interview summaries and provide feedback on revisions to item sets before the next round of interviews. After the cognitive interviews reach a point of diminishing return in terms of identifying changes needed, we will use the finalized pilot survey to conduct a quantitative pilot study with youth and educators at the three partner organizations. Each partner organization will recruit 200 youth (600 total youth) in grades 5-8 to complete the pilot student survey. In addition, all educators at each partner organization will be invited to complete the educator survey.

*Phase 1b Analysis.* The goal of Phase 1b will be to refine and finalize research tools for Phase 2. A substantial part of this effort will focus on survey analysis to psychometrically test and gather validity evidence for the newly developed youth survey scales. Psychometric analysis of the survey scales will include factor analysis, reliability analysis, and differential item functioning (DIF). To evaluate the dimensionality of the item sets, we will perform confirmatory factor analyses using Mplus 8.4 (Muthén & Muthén, 2020), exploring unidimensional scale models (i.e., one dimension for each scale). Assuming the new scales are ordinal, we will then assess the ordinal scale reliability (Zumbo et al., 2007), the distribution of respondents across items, and the distribution of items across the range of respondents. Moreover, given the goal of these new scales is to create scales with lesser cultural bias than previous measures, it is critical that these tools are not subject to cultural or linguistic bias. Thus, DIF analyses will be conducted by racial ethnic identity, gender identity, and by whether or not English is spoken at home to establish that the items function equally well across these differences in our samples.

*Phase 2 (Year 3)* In Phase 2, we will use the products of Phase 1 to measure the extent to which outdoor science programs support positive changes in participating youths' science and environmental literacy outcomes, as well as how youth of color make meaning of the experiences. The specific design—including both instruments and methods—of Phase 2 will be largely shaped by learnings in Phase 1. At present, we envision a mixed methods approach, with two tiers of data collection. Tier 1 will include post/ retrospective-pre youth surveys with a large sample of youth and OSEL educators across the country. Tier 2 data collection will include more in-depth data collection at a subset of case sites, with both the quantitative surveys as well as qualitative youth focus groups and educator interviews. Below, we describe our current vision of Phase 2, with recognition that methods may shift through Phase 1.

Participants: The study will draw from the existing network of outdoor science education programs brought together through the BEETLES project, a project of the Lawrence Hall of Science led by Co-PI Foreman. From 2014 to 2019, BEETLES implemented a total of 10 leadership Institutes and worked directly with program leaders from 156 outdoor science organizations to build their capacity to implement high quality science teaching and learning. Leveraging existing relationships formed by the BEETLES program and research projects, we will purposefully recruit a sample of 10-15 programs that are approximately equally split between residential (in which youth travel to the program site) and non-residential (in which youth participate in local programs in their school yards or community). We will also work with our CRN and Project Advisors to identify 10-15 additional organizations not included in the original BEETLES project, with a particular effort made to recruit organizations intentionally engaging youth of color with a multitude of racial and ethnic identities.

For Tier 1, we will work with program leaders to recruit two classrooms of students to participate in our study (n=50 students per program), for a total of approximately 1,000-1,500 youth (grades 5-6). We will also recruit 2 outdoor educators from each program to participate in the educator survey, for a total of 40-60 outdoor educators. For Tier 2, we will purposefully select 3 case sites, with input from our CRN and Advisory Council to identify sites with particularly valuable opportunities to learn about how youth of color make meaning of OSEL experiences. In addition to the Tier 1 surveys at these sites, we will also recruit 4-5 youth from each program to participate in focus groups and two educators from each program to participate in educator interviews.

Phase 2 Instruments, Procedures, and Analysis We currently envision Phase 2 to include youth surveys, educator surveys, youth focus groups, and educator interviews, described below.

*Youth Survey.* The youth survey will use a post/retrospective pre format. Retrospective pretests have been argued to be preferable to traditional pretests when using self-report measures in informal settings, because of changes in awareness, knowledge, and/or perceptions of the construct being studied over time (Sibthorp et al., 2007). Post/retrospective pre-survey designs are useful to reduce “response shift bias” (Howard et al., 1979), to reduce data loss between pre- and post-testing, and to reduce the burden on respondents (Klatt & Taylor-Powell, 2005). Depending on the final number of scales, we may use a matrix sampling approach, such that each respondent completes a subset of survey scales, counterbalanced so that there are approximately equal numbers of respondents for each scale. This approach will provide sufficient data on each outcome to be able to make



meaningful connections across constructs, while also not overburdening participants with an excessively long survey.

Though the specific scales used in Phase 2 will be designed and piloted in Phase 1, the study will draw upon the expertise developed through the Lawrence's prior work developing, revising, and administering science and STEM attitudinal and dispositional surveys and scales through the Activation Lab, across diverse projects, content areas, settings and populations (e.g., Collins et al., in preparation; Cannady et al., 2022). In addition, depending on the final measures developed in Phase 1, select Activation subscales may be used as a means toward gathering evidence of concurrent criterion validity, or the extent to which the produced measures are predictive of scores on other, related measures (Sirechi, 1998). For example, if one of our final measures relates to youths' sense of efficacy or confidence in science, we may draw on the Science Competency Beliefs subscale (Chung et al., 2016a) as a criterion validity reference point. Similarly, if one of the final measures focuses on the extent to which youth see the utility and value of science in their lives and communities, we will draw on the Science Values Scale (Chung et al., 2016b) as a criterion validity reference point. The PI team has experience with scales measuring interest and curiosity (Science Fascination; Chung et al., 2016c), problem solving (STEM Innovation stance; Chen et al., 2017); scientific sensemaking (Cannady et al., 2019) Comfort in Nature (Nisbet et al., 2008), and environmentally-aware decision making (Collins et al., in preparation).

*Educator Survey.* The educator survey will include a series of closed- and open-ended questions to gather information on the characteristics of the learning experience in which the surveyed youth participate (e.g., contact hours, content, group size), as well as general information about the organization and the educators themselves. These surveys will be piloted in Phase 1 through cognitive interviews with educators at partner organizations, before being revised and used with all sites in Phase 2.

**Case Site Data Collection** Case site data collection will be structured to gather data to answer RQ4: How do youth of color make meaning of [OSEL] learning experiences? With support from the organizational partners, we will recruit 5 youth of color per program to serve as focal youth, who will be the focus of data collection activities: the observation, and interviews or youth focus groups.

*Program Observations.* One member of the research team will travel to each case site to observe program activities, with the aim of understanding how the learning experience supports positive growth in science and environmental literacy and dispositions literacy. The site visit will also include focus groups with youth and interviews with educators.

*Youth focus groups or individual interviews.* The youth focus group and/or interview protocols, developed in collaboration with the CRN, will be semi-structured with a series of prompts to hear from youth of color about their experiences in the OSEL program and its impact on them, as well as their reflections on how the experience differed from previous learning experiences in a way that allowed them to foster existing interests and/or develop more positive dispositions toward and literacy around science and the environment. Focus groups will be conducted at three timepoints: early in the OSEL experience, near the end of the OSEL experience, and 3-6 months after the conclusion of the OSEL experience, to learn about trajectories of youths' development and shifting perspectives on the experience and their own STEM and environmental literacy and dispositions.

*Educator interview protocol.* To complement data collected from youth, the semi-structured educator interview protocol will gather educators' perceptions of outcomes for youth participating in the program as well as what features of experiences allow youth of color to thrive.

*Analysis - Phase 2.* To answer RQ3, we will conduct a series of analyses using multilevel modeling (students nested within programs) to test for differences in science and environmental literacy scores between pre and post. Subgroup analyses will also examine whether there are differences in outcomes or trajectories based on racial, ethnic, or gender identity. Finally, data from the educator survey will be used to investigate patterns in outcomes based on programmatic or organizational features, including whether there are differences in relations between features and outcomes by subgroups of students. To answer RQ4, we will draw largely from Tier 2 (case site) data. We will inductively code youth focus group and educator interview transcripts to identify

themes around the factors influencing youth of color's learning and growth in OSEL experiences. We will also code open-ended responses from the Tier 1 surveys to have a sense of similarities and differences between case site themes and general themes across the national sample. At various points in the analysis, we will engage the CRN in analysis and sensemaking, with a particular focus on informing implications for the field. At the end of Phase 2, in partnership with the CRN, we will begin to explore dissemination approaches and processes to support collaborative authorship and dissemination (see Communication Plan).

*Phase 3* (Year 4) Phase 3 will be focused on collaborative sensemaking and dissemination. We will share findings and discuss implications for the field with Phase 1 participants, and together with the CRN, consultants, and advisors, we will develop a proposed conceptual framework that explores the relationship between scientific and environmental literacy outcomes and structures within and adjacent to outdoor science organizations that allow for youth to thrive. We will also co-author research manuscripts, practitioner briefs, and conference presentations. Dissemination strategies are described below.

## Communication Plan

We will use a multi-pronged communication strategy to widely disseminate findings and products. These efforts will focus on disseminating both findings related to our process and effective practices for community-driven participatory design efforts in STEM as well as research findings, validated learning outcomes, and the proposed conceptual framework. We will include CRN participants in dissemination efforts, including in co-authoring publications and co-presenting at conferences. Dissemination will be directed toward the following primary audiences: OSEL professionals, informal science professionals, and educational researchers.

We will reach OSEL professionals primarily through the Justice Outside and Lawrence Hall of Science networks for recruitment (over 400 organizations and over 6,000 individual subscribers total) along with multiple national networks including: the People of the Global Majority in the Outdoors, Nature, and Environment (PGM ONE); Cultivating Community Outdoors (a national conference centering center Black, Indigenous, and Communities of Color); North American Association of Environmental Education (NAAEE); NAAEE's State Affiliate network and groups; Association of Nature Center Administrators (ANCA); and National Association of Interpreters (NAI). We will reach educational researchers through: 1) formal education research conference presentations (AERA, NARST, NAAEE Research Symposia) and 2) publication of findings in peer-reviewed publications (e.g., Environmental Education Research). We will also disseminate findings to families and community members at participating OSEL organizations, leveraging the expertise of the CRN to develop public-facing research briefs that are accessible and engaging to the communities they work with.

## Evaluation

As an external consultant, Dr. Bernadette Chi will lead the project evaluation and has extensive experience in research and evaluation of educational and community-based programs over the last 20 years, including well-regarded multi-year evaluations of NSF-funded studies across directorates. She will be responsible for the development of evaluation instruments, data collection and analysis, and presentation of findings. Guided by the questions detailed in the table below, the evaluation will focus on systematically gathering feedback from project team leaders and participants through surveys, interviews and focus groups to document implementation of project activities for accountability, and to offer feedback to the project PIs at regular and timely intervals for iteration and improvement by reflecting on what aspects of the project are working well and what could be improved. The evaluation approach is designed to gather diverse perspectives from multiple sources, including the Lawrence team and all partners and collaborators, and to provide both formative feedback and summative reflections. Findings will be provided to project leadership on an ongoing basis through quarterly meetings and learning memos twice a year, as well as through a final report.

Table 2: Evaluation and Assessment Tools

Evaluation Questions	Data Collection Tools and Sources	Deliverables
1) To what extent is the proposed project/study being implemented as planned? What components have worked well? What can be improved? 2) To what extent has the project been designed and implemented to be inclusive and equitable? What has worked well? What can be improved? 3) In what ways, if any, is the proposed project adding value to the OSEL field in terms of both process and outcomes?	<ul style="list-style-type: none"> <li>○ Participation in project planning meetings</li> <li>○ Observation of CRN planning meetings</li> <li>○ Project team reflection focus groups</li> <li>○ Focus groups with each CRN partner</li> <li>○ Facilitation of annual advisory team meeting</li> <li>○ Participant feedback forms post-CRN meetings</li> <li>○ Ongoing review of project materials</li> </ul>	Learning memos twice each year to project PI's and staff to inform program changes  Final report to project PIs to submit to NSF

The evaluation activities will include the following:

- Participation in Year 1 Project Team planning meetings to understand and document the process of participatory and equitable design, development and implementation of the research study
- Observations of CRN planning meetings to document how the project is enacting participatory approaches, and what about the process is working well or could be improved.
- Facilitation of project team Reflective Conversations to enable regular opportunities for the project team to document the process and consider what is going well and could be improved, emerging ideas, and priorities/concerns in coming months (quarterly in Year 1; mid-point and end of year sessions to inform adjustments to project activities during Years 2-3; mid-point and end of year session in Year 4 to be more reflective/summative to inform future pathways for the work)
- Facilitation of focus groups with CRN (two focus groups with each partner organization team per year) to document and reflect on partner organizations' experiences with the project, what is working/not working about the current process, and other ways they would like to be involved
- Administration and summary of brief participant feedback forms after each CRN meeting to capture what worked/could be improved, to be shared with project leaders for future planning.
- Planning, facilitation and debrief of annual Advisory Council meetings (Years 1 - 4)
- Review of materials including protocols, surveys, conceptual framework, and findings (all years)
- Development and sharing of learning memos (2x year) in Year 1 will be written and shared after the development of definitions and the survey instrument to collect feedback from CRN, and after the pilot study; in Years 2-4, learning memos to be shared at mid-point and end of each year.)

In conducting the evaluation, Dr. Chi will closely collaborate with the research team to coordinate data collection and analyses to minimize the burden on project participants, as well as secure human subject approval for the evaluation activities. She will meet regularly with the PIs to support the integration of evaluation findings into the ongoing project management.

## Project Management

The scope of this research effort requires significant organizational and management expertise, as well as an institutional infrastructure with the capacity to engage in large scale studies of this type. The Lawrence Hall of Science is a trusted and stable institution with a long-standing track record of STEM research and evaluation across diverse settings and scales. The project team has 1) deep expertise and reliable networks within the communities of outdoor, informal and formal science education, 2) successful experience designing professional learning for and research studies with outdoor, informal and formal science educators, 3) deep understanding of the unique challenges and significant opportunities in outdoor science education, and 4) the expertise, experience, and infrastructure for designing and managing large scale assessment, research, and evaluation

efforts and a proven track record of success of doing so. The entire project team and Advisory Council includes experts in science and environmental learning, research and evaluation. The entire team is described in detail below.

#### Leadership Team

**Melissa Collins Ph.D. (PI)**, will provide overall intellectual, technical, and operational leadership of the project. Dr. Collins is a Senior Research Lead in the Environmental Learning Initiative at the Lawrence Hall of Science at the University of California, Berkeley. Together with Romero, she was research lead on the BEETLES project, which studied (1) the implementation of a capacity-building model to improve teaching and learning in outdoor science organizations, (2) the impact of these organizations on youths' dispositions toward science and the environment, and (3) the impact of the COVID-19 pandemic on the OSEL field. Collins received her Ph.D. in Applied Developmental and Educational Psychology from Boston College and her BA in Psychology from Harvard College.

**Valeria Romero, M.A. (Co-PI)** will lead project activities as a research specialist with an emphasis on equity and participatory methods. Romero is a Senior Research Lead in the Environmental Learning Initiative at the Lawrence Hall of Science at the University of California, Berkeley. Romero has over a decade of experience conducting research and evaluation in the field of OSEL, with an emphasis on centering racial equity. She received her master's degree in educational leadership from Mills College.

**Jedda Foreman, M.B.A. (Co-PI)**, will lead project activities as an Environmental Learning Specialist with an emphasis on equity in the OSEL field. Foreman is the Director of the Environmental Learning Initiative at the Lawrence Hall of Science at the University of California, Berkeley. Foreman brings over fourteen years of environmental education field experience, curriculum and professional learning development, and project management. She is project director on the BEETLES project from which the current work stems. She has a B.A. from Carleton College, an MBA from California College of the Arts, and a Graduate Certificate in Field Science and Place-Based Education from Teton Science Schools.

#### Results from Prior NSF Support

The PIs have a successful history of collaborating on NSF-funded projects.

**DRL 1949586: \$1,471,693 (9/1/2020-8/31/2024)**. Collins and Romero are Co-PIs of Youth Engaged in STEM and Service. *Intellectual Merit*: This project contributes to the field's understanding of how to design culturally relevant programs for middle school youth of color and girls through two summer camps integrating solar power, engineering, and STEM identity development. The research study, through surveys, observations, and interviews, seeks to understand the impact, strengths, and challenges of the two program designs, with important implications for STEM programmatic decision-making. The evaluation, through observations and interviews, will contribute to understanding on how to cultivate equitable partnerships and a sustainable program model. *Broader Impacts*: The project will enable broader participation in STEM by pushing researchers and program designers to think critically about culturally responsive program design and how to build our collective capacity to provide equitable and inclusive STEM learning experiences. *Publications*: No publications have been published to date. *Products*: The project has designed curricula for two two-week, solar-technology summer programs for middle school youth.

**DRL 2005829: 1,999,323 (9/1/2020-8/31/2023)**. Romero and Foreman are Co-PIs of Working Toward Equitable Organizations: Building Capacity for Leadership of Color in Outdoor and Environmental Science Education. *Intellectual Merit*: This project contributes to innovative approaches to building the capacity of OESE program leaders and professionals of color to work towards equitable workplaces. The research component aims to understand, through surveys and case studies, for whom and under what conditions organizations are able to make equitable institutional change. The project evaluation, using survey data feedback forms, supports ongoing improvements and enhancements to the design and implementation of the professional learning model. *Broader Impacts*: The project directly impacts 20 OESE nationwide, 150 organization leaders, and 90 professionals of color. *Publications*: So far, this project has resulted in five conference presentations.

Additional Project Team Members **Craig Strang**, former Associate Director of the Lawrence Hall of Science, will provide expertise on the OSEL field and science and environmental literacy. **Alex Sanchez**, Research

Coordinator at the Lawrence Hall of Science, will support data collection, analysis, and dissemination of results. **Corinne Calhoun**, Environmental Learning Coordinator at the Lawrence Hall of Science, will serve as project coordinator. **Tim Hurt**, Computer Science Education Lead at the Lawrence Hall of Science, will support data management, psychometric analysis, and multilevel modeling.

Partners. Organization partners will have a seat on the project Advisory Council and will support recruitment of the Community Research Network and research participants, support the piloting of student surveys, and contribute to writing and disseminating findings. An annual stipend to one organization leader at each partner site will be provided to compensate for project activities all four years. Community Research Network members will also receive an honorarium in years 1, 2, and 4. The three organizations were chosen to reflect a diversity of organizational structures, histories, and approaches to equity. **Yes Nature to Neighborhoods (YES)** is a community organization based in Richmond, California. YES focuses on cultivating leadership among Richmond youth, adults, and whole families through year-round training, strong mentorship, and profound experiences in nature; increasing access and breaking down barriers for those historically excluded from the outdoors; and collaborating at the forefront of the movement to increase equity and inclusivity in the outdoors. YES has over 50 community partners and a network of over 500 actively involved community members attending and participating in events. **NatureBridge** is the largest education partner of the National Park Service. Through multi-day, residential outdoor school programming in four sites in Yosemite National Park and the Golden Gate National Recreation Area in California, Olympic National Park in Washington, and Prince William Forest Park in Virginia, NatureBridge connects over 35,000 students from 700 schools each year to the wonder and science of the natural world. **Wabanaki Youth in Science (WaYS)** is a grass roots, community-based educational model that started in 2013 with initial financial support from the National Science Foundation's Experimental Program to Stimulate Competitive Research (NSF EPSCoR). WaYS serves to support Maine Native youth to persist in science through collaborations with Cultural Knowledge Sharer (CKS) and western science professionals at camps, after-school programs and internships. All programs focus on Traditional Ecological Knowledge (TEK) and the concept "two eyed learning" or students being able to learn about the world through both western science and cultural science vantage points.

Research & Data Equity Consultants The Research Justice Institute (RJI) at the Coalition of Communities of Color (CCC) will act as consultants on research design and implementation. In particular, CCC will support the team in 1) creating a BIPOC-led research design, including addressing equitable community involvement in the research process, prioritizing common goals, and centering BIPOC voices; 2) ensuring equitable research strategies; and 3) ensuring data equity strategies. Across Phases 1 and 2, they will participate in CRN, research planning, and Advisory Council meetings; review instruments; contribute to collaborative sensemaking; and support dissemination efforts.

Advisory Council The Advisory Council will ensure the research study in its design and broader impacts are situated within and responsive to the current state of research in the fields of outdoor science, environmental learning and informal science. In years 1 through 3, advisors will provide input on the study design (e.g., sampling approaches and inclusion criteria) and instruments (i.e., surveys and interview/focus group protocols). In year 4, Advisory Council members will be instrumental in framing findings and implications for the outdoor and environmental learning field to ensure relevance and impact for both research and practice. Advisors for this project have been carefully selected to provide expertise on 1) equity and justice (2) the landscape of the OSEL field, and 3) best practices in research and evaluation. Advisors will include: **Laura Rodriguez**, Chief Program Officer, Justice Outside, who brings expertise in racial equity, inclusion, and cultural relevance in the outdoors; **Cathy Jordan**, Director of Leadership & Education, Institute on the Environment at University of Minnesota, who brings expertise on nature exposure and child development; **Marc Stern**, Professor of Forest Resources Environmental Conservation at Virginia Tech, who brings expertise on environmental attitudes and actions research and evaluation; representatives from the project's three partner organizations: **Miho Aida**, Director of Equity, Inclusion & Diversity, NatureBridge; **Tish Carr**, Executive Director, Wabanaki Youth in Science (WaYS); **Blanca Hernández**, Director of Programs & Partnerships, YES Nature to Neighborhoods; and **Dr. Andres Lopez**, Research Director, Coalition of Communities of Color.



**Project Management Plan.** Our project management plan builds on the detailed and successful practices currently in place for the previous work completed by the PI team. These practices include: clearly defined team roles, weekly team meetings along with brief check-ins as necessary, bi-weekly leadership team meetings, and online document sharing. Our team uses Box for Business to share, manage, and work collaboratively on documents. We also make use of shared Google calendars to maintain a consistent and reliable schedule, and the UC Berkeley server for document backup and long-term storage. The team uses Zoom for distance meetings with advisors, consultants, and partners. We use cloud-based platforms, like Google Drive, to communicate with off-site partners in order to quickly share and exchange documents and information, track important dates and meetings, and maintain a forum for discussion and community between partners. The timeline below delineates the work plan for this project.

**Figure 1. Project Timeline**

	2024		2025		2026		2027	
	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec
<b>Phase 1 - Ground Truthing and Defining Science and Environmental Literacy Outcomes</b>								
Community Research Network Meetings								
Facilitated focus groups w/community members at partner orgs								
Community-engaged sense-making								
Student survey development and cognitive lab interviews								
Student survey pilot testing								
Data analysis - themes								
<b>Phase 2 - Measuring the Impact of Outdoor Science and Environmental Learning Experiences</b>								
National study								
Case site data collection (focal youth and educators)								
Data analysis - impact & meaning-making								
Community-engaged sensemaking								
<b>Phase 3 - Collaborative Dissemination of Project Findings</b>								
Develop conceptual framework								
Share research findings								
<b>All Project Activities</b>								
Advisory Council Meetings								
Evaluation data collection and formative feedback through learning memos								
Evaluation summative report								



## References

- Anyon, J. (1981). Social class and school knowledge. *Curriculum Inquiry*, 11(1), 3-42.  
<https://doi.org/10.2307/1179509>
- Ardoin, N. M. & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review*, 31(100336).  
<https://doi.org/10.1016/j.edurev.2020.100353>
- Ardoin, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2018). Environmental education and K-12 student outcomes: A review and analysis of research. *The Journal of Environmental Education*, 49(1), 1-17. <https://doi.org/10.1080/00958964.2017.1366155>
- Avcı, G., & Gümüş, N. (2020). The effect of outdoor education on the achievement and recall levels of primary school students in social studies course. *Review of International Geographical Education Online*, 10(2), 171-206. <http://dx.doi.org/10.33403/rigeo.638453>
- Becker, C., Lauterbach, G., Spengler, S., Dettweiler, D., & Mess, F. (2017). Effects of regular classes in outdoor education settings: A systemic review on students' learning, social and health dimensions. *International Journal of Environmental Research and Public Health*, 14(5), 1-20.  
<https://doi.org/10.3390/ijerph14050485>
- Bell, D. (1992). Racial realism. *Connecticut Law Review*, 24(2), 363-380.  
<https://www.law.nyu.edu/sites/default/files/Racial%20Realism.pdf>
- Brown, B. A., Reveles, J. M., & Kelly, G. J. (2004). Scientific literacy and discursive identity: A theoretical framework for understanding science learning. *Science Education*, 89(5), 779-802.  
<https://doi.org/10.1002/sce.20069>
- Bybee, R. W. (1995). Achieving scientific literacy. *The Science Teacher*, 62(7), 28-32.
- California Department of Education. (2015). *A blueprint for environmental literacy*. A Report by State Superintendent of Public Instruction Tom Torlakson's Environmental Literacy Task Force. Accessed December 13 2022 via  
<https://www.cde.ca.gov/pd/ca/sc/documents/envronliteracyblueprint.pdf>
- Cannady, M. A., Montgomery, R., Hurt, T., Collins, M., Allan, S., Brodsky, L., Greenwald, E., Krakowski, A., & Dorph, R. (2022). *Technical report: Measuring Computational Thinking for Science (CT-S)*. Berkeley, CA: Lawrence Hall of Science at University of California, Berkeley. Retrieved from: <https://www.lawrencehallofscience.org/research/>
- Cannady, M. A., Vincent-Ruz, P., Chung, J. M., & Schunn, C. D. (2019). Scientific sensemaking supports science content learning across disciplines and instructional contexts. *Contemporary Educational Psychology*, 59, 101802. <https://doi.org/10.1016/j.cedpsych.2019.101802>
- Carrier, S. J. (2009). Environmental education in the schoolyard: Learning styles and gender. *The Journal of Environmental Education*, 40(3), 2-12.
- Chen, Y.-F., Cannady, M. A., Schunn, C., & Dorph, R. (2017). *Measures Technical Brief: Innovation Stance in STEM*. Retrieved from <http://activationlab.org/tools/>

- Chung, J., Cannady, M. A., Schunn, C., Dorph, R., & Vincent-Ruz, P. (2016a). Measures Technical Brief: Competency Beliefs in Science. Retrieved from: <http://www.activationlab.org/wp-content/uploads/2016/02/CompetencyBeliefs-Report-3.2-20160331.pdf>
- Chung, J., Cannady, M. A., Schunn, C., Dorph, R., & Bathgate, M. (2016b). Measures Technical Brief: Valuing Science. Retrieved from: <http://www.activationlab.org/wp-content/uploads/2016/02/Values-Report-3.2-20160331.pdf>
- Chung, J., Cannady, M. A., Schunn, C., Dorph, R., & Bathgate, M. (2016c). Measures Technical Brief: Fascination in Science. Retrieved from: <http://www.activationlab.org/wp-content/uploads/2016/02/Fascination-Report-3.2-20160331.pdf>
- Collins, M. A., Dorph, R., Foreman, J., Pande, A., Strang, C., & Young, A. (2020). *A field at risk: The impact of COVID-19 on environmental and outdoor science education: Policy brief*. Lawrence Hall of Science, University of California, Berkeley; California.  
[https://www.lawrencehallofscience.org/wpcontent/uploads/2021/10/EE\\_A\\_Field\\_at\\_Risk\\_Policy\\_Brief.pdf](https://www.lawrencehallofscience.org/wpcontent/uploads/2021/10/EE_A_Field_at_Risk_Policy_Brief.pdf)
- Collins, M. A., Pande, A., Strang, C., Foreman, J., & Dorph, R. (2021). *Impacts from COVID-19: Resilient outdoor science programs need support as challenges persist*. Policy brief. Lawrence Hall of Science, University of California, Berkeley; California.  
[https://www.lawrencehallofscience.org/wp-content/uploads/2022/02/impacts-from-covid-19-osps\\_2-2022.pdf](https://www.lawrencehallofscience.org/wp-content/uploads/2022/02/impacts-from-covid-19-osps_2-2022.pdf)
- Collins, M. A., Young, A., Romero, V., Laina, V., Pande, A., Foreman, J., Dorph, R., & Strang, C. (in preparation). The disproportionate benefits of outdoor science programs on youth of color's dispositions toward science and the environment. To be submitted to Environmental Education Research.
- Collins, P. H. (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment, 2nd Edition*. Routledge.
- Cornwall, A., & Jewkes, R. (1995). What is participatory research? *Social Science & Medicine*, 41(12), 1667-1676. [https://doi.org/10.1016/0277-9536\(95\)00127-S](https://doi.org/10.1016/0277-9536(95)00127-S)
- Coyle, K. J. (2010). *Back to school: Back outside! How outdoor education and outdoor school time create high performance students*. National Wildlife Federation.  
<https://www.nwf.org/Educational-Resources/Reports/2010/09-01-2010-Back-to-School-Back-Outside>
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241-1300.  
<https://blogs.law.columbia.edu/critique1313/files/2020/02/1229039.pdf>
- Crenshaw, K., Gotanda, N., Peller, G., & Thomas, K. (1995). Introduction. In K. Crenshaw, N. Gotanda, G. Peller, & K. Thomas (Eds.), *Critical race theory: The key writings that formed the movement* (xiii - xxxii). The New Press.
- Crompton, J. L., & Sellar, C. (1981). Do outdoor education experiences contribute to positive development in the affective domain? *The Journal of Environmental Education*, 12(4), 21-29.  
<https://doi.org/10.1080/00958964.1981.9942638>

- DeBoer, G. E. (2000). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching*, 37(6), 582-601. [https://doi.org/10.1002/1098-2736\(200008\)37:6%3C582::AID-TEA5%3E3.0.CO;2-L](https://doi.org/10.1002/1098-2736(200008)37:6%3C582::AID-TEA5%3E3.0.CO;2-L)
- Delgado Bernal, D. (2002). Critical race theory, Latino critical theory, and critical raced-gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative Inquiry*, 8(1), 105-126. <https://doi.org/10.1177/107780040200800107>
- Delgado, R., & Stefancic, J. (2017). *Critical Race Theory: An introduction*. New York University Press.
- Dorph, R., Cannady, M. A., & Schunn, C. D. (2016). How science learning activation enables success for youth in science learning experiences. *Electronic Journal of Science Education*, 20(8). <https://eric.ed.gov/?id=EJ1188039>
- Ericsson, K. A., & Simon, H. A. (1993). *Protocol Analysis: Verbal reports as data (Revised Edition)*. Cambridge, MA: Massachusetts Institute of Technology.
- Fančovičová, J., & Prokop, P. (2011): Plants have a chance: outdoor educational programmes alter students' knowledge and attitudes towards plants. *Environmental Education Research*, 17(4), 537-551. <http://dx.doi.org/10.1080/13504622.2010.545874>
- Finney, C. (2014). *Black faces, white spaces: Reimagining the relationship of African Americans to the great outdoors*. UNC Press Books.
- Ford, R. (1994). Boundaries of race: Political geography in legal analysis. *The Harvard Law Review* 107(8), 1841-1921. <https://doi.org/10.2307/1341760>
- Gibson, L. M., Busch, K. C., Stevenson, K. T., Cutts, B. B., DeMattia, E. A., Aguilar, O. M., Ardoin, N. M., Carrier, S. J., Feinstein, N. W., Goodwin, J., Peterson, M. N., & Wheaton, M. (2022). What is community-level environmental literacy, and how can we measure it? A report of a convening to conceptualize and operationalize CLEL. *Environmental Education Research*, 28(10), 1-29. <https://doi.org/10.1080/13504622.2022.2067325>
- Godwin, A. (2020). Sitting in the tensions: Challenging Whiteness in quantitative research. *Studies in Engineering Education*, 1(1), 78–82. <http://doi.org/10.21061/see.64>
- Gonzales, P., Williams, T., Jocelyn, L., Roey, S., Kastberg, D., & Brenwald, S. (2008). *Highlights from TIMSS 2007: Mathematics and science achievement of U.S. fourth- and eighth-grade students in an international context* (NCES 2009–001 Revised). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. <https://nces.ed.gov/pubs2009/2009001.pdf>
- Harris, C. I. (1993). Whiteness as property. *Harvard Law Review*, 106(8), 1707-1791. <https://doi.org/10.2307/1341787>
- Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a Framework for Assessing Environmental Literacy*. Washington, DC: North American Association for Environmental Education.
- Howard, G. S., Ralph, K. M., Gulanick, N. A., Maxwell, S. E., Nance, D. W., & Gerber, S. K. (1979).

- Internal invalidity in pretest-posttest self-report evaluations and a reevaluation of retrospective pretests. *Applied Psychological Measurement*, 3(1), 1-23.  
<https://doi.org/10.1177/014662167900300101>
- Hurd, P. D. (1997). Scientific literacy: New minds for a changing world. *Science Education*, 82(3), 408-416.
- Israel, B. A., Eng, E., Schulz, A. J., & Parker, E. A. (Eds.). (2012). *Methods for community-based participatory research for health*. John Wiley & Sons, Incorporated.
- Johnson, B., & Manoli, C. C. (2010). The 2-MEV scale in the United States: a measure of children's environmental attitudes based on the theory of ecological attitude. *The Journal of Environmental Education*, 42(2), 84-97. <https://doi.org/10.1080/00958964.2010.503716>
- Klatt, J., & Taylor-Powell, E. (2005, October). *Synthesis of literature relative to retrospective pretest design* [Paper presentation]. 2005 Joint CES/AEA Conference, Toronto, Canada.
- Kuo, M., Browning, M. H. E. M., & Penner, H. L. (2018). Do lessons in nature boost subsequent classroom engagement? Refueling students in flight. *Frontiers in Psychology*, 8(2253), 1-15.  
<https://doi.org/10.3389/fpsyg.2017.02253>
- Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education? *International Journal of Qualitative Studies in Education*, 11(1), 7-24.  
<https://doi.org/10.1080/095183998236863>
- Laugksch, R. C. (1999). Scientific literacy: A conceptual overview. *Science Education*, 84, 71-94.  
[https://doi.org/10.1002/\(SICI\)1098-237X\(200001\)84:1%3C71::AID-SCE6%3E3.0.CO;2-C](https://doi.org/10.1002/(SICI)1098-237X(200001)84:1%3C71::AID-SCE6%3E3.0.CO;2-C)
- Learning in Places Collaborative. (2021). *Family and community framework for engagement and collaboration*. Bothell, Seattle, WA & Evanston, IL: Learning in Places.
- Leighton, J. P. (2004). Avoiding misconception, misuse, and missed opportunities: The collection of verbal reports in educational achievement testing. *Educational Measurement: Issues and Practice*, 23(4), 6-15. <https://psycnet.apa.org/doi/10.1111/j.1745-3992.2004.tb00164.x>
- Lewis, S., & James, K. (1995). Whose voice sets the agenda for environmental education? Misconceptions inhibiting racial and cultural diversity. *The Journal of Environmental Education*, 26(3), 5-12. <https://doi.org/10.1080/00958964.1995.9941440>
- Louv, R. (2005). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin Books.
- Maina-Okori, N. M., Koushik, J. R., & Wilson, A. (2018). Reimagining intersectionality in environmental and sustainability education: A critical literature review. *The Journal of Environmental Education*, 49(4), 286-296. <https://doi.org/10.1080/00958964.2017.1364215>
- Mann, J., Gray, T., Truong, S., Brymer, E., Passy, R., Ho, S., Sahlberg, P., Ward, K., Bentsen, P., Curry, C., & Cowper, R. (2022). Getting out of the classroom and into nature: A systematic review of nature-specific outdoor learning on school children's learning and development. *Frontiers in Public Health*, 10(877058), 1-12. <https://doi.org/10.3389/fpubh.2022.877058>

- Matsuda, M. J. (1987). Looking to the bottom: Critical legal studies and reparations. *Harvard Civil Rights-Civil Liberties Law Review*, 22(2), 323-400. <http://hdl.handle.net/10125/65944>
- McLean, S. (2013). The whiteness of green: Racialization and environmental education. *The Canadian Geographer/le Géographe Canadien*, 57(3), 354–362. <https://doi.org/10.1111/cag.12025>
- McLeod, B., & Allen-Craig, S. (2007). What outcomes are we trying to achieve in our outdoor education programs? *Journal of Outdoor and Environmental Education*, 11(2), 41-49. <https://doi.org/10.1007/BF03400856>
- Mislevy, R. J., & Riconscente, M. M. (2005). *Evidence-centered Assessment Design: Layers, Structures, and Terminology*. PADI Technical Report 9.
- Muthén, L. K., & Muthén, B. O. (2020). *Mplus 8.4*. Los Angeles, CA.
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2008). The Nature Relatedness Scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, 41(5), 715-740. <https://journals.sagepub.com/doi/pdf/10.1177/0013916508318748>
- Nxumalo, F. (2021). Decolonial water pedagogies: Invitations to Black, Indigenous, and Black-Indigenous world-making. *Occasional Paper Series*, 2021(45). <https://doi.org/10.58295/2375-3668.1390>
- Nxumalo, F., & Cedillo, S. (2017). Decolonizing place in early childhood studies: Thinking with Indigenous onto-epistemologies and Black feminist geographies. *Global Studies of Childhood*, 7(2), 99–112. <https://doi.org/10.1177/2043610617703831>
- Peacock, J., Bowling, A., Finn, K., & McInnis, K. (2021). Use of outdoor education to increase physical activity and science learning among low-income children from urban schools. *American Journal of Health Education*, 52(2), 92-100. <https://doi.org/10.1080/19325037.2021.1877222>
- Peller, G. (1990). Race consciousness. *Duke Law Journal*, 1990(4), 758-847. <https://www.jstor.org/stable/1372723>
- Pérez, M. S., & Saavedra, C. M. (2017). A call for onto-epistemological diversity in early childhood education and care: Centering global south conceptualizations of childhood. *Review of Research in Education*, 41(1), 1–29. <https://doi.org/10.3102/0091732X16688621>
- Powell, R. B., Stern, M. J., Krohn, B. D. & Ardoin, N. (2011). Development and validation of scales to measure environmental responsibility, character development, and attitudes toward school. *Environmental Education Research*, 17(1), 91-111. <https://doi.org/10.1080/13504621003692891>
- Roberts, D. A. (2007). Scientific literacy/Science literacy. In S. K. Abell & N. G. Lederman (Eds.). *Handbook of Science Education* (pp. 729-780.) Routledge.
- Roth, C. E. (1992). *Environmental Literacy: Its roots, evolution, and directions in the 1990s*. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Sablan, J. R. (2019). Can you really measure that? Combining critical race theory and quantitative methods. *American Educational Research Journal*, 56(1), 178–203. <https://doi.org/10.3102/0002831218798325>



- Sibthorp, J., Paisley, K., Gookin, J., & Ward, P. (2007). Addressing response-shift bias: Retrospective pretests in recreation research and evaluation. *Journal of Leisure Research*, 39(2), 295-315. <https://doi.org/10.1080/00222216.2007.11950109>
- Sireci, S. G. (1998). The construct of content validity. *Social Indicators Research*, 45, 83–117.
- Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). Planning early for careers in science. *Science*, 312, 1143–1144. <https://doi.org/10.1126/science.1128690>
- Tal, T., Levin-Peled, R., & Levy, K. S. (2019). Teacher views on inquiry-based learning: the contribution of diverse experiences in the outdoor environment. *Innovation and Education*, 1(1), 1-17. <https://doi.org/10.1186/s42862-019-0004-y>
- Training Resources for the Environmental Community. (2021, October). *US conservation and colonialism timeline*. Training Resources for the Environmental Community. <https://www.trec.org/resources/us-conservation-colonialism-timeline/>
- Tuck, E. (2009). Suspending Damage: A Letter to Communities. *Harvard Educational Review*, 79(3), 409–428. <https://doi.org/10.17763/haer.79.3.n0016675661t3n15>
- Tuck, E., McKenzie, M., & McCoy, K. (2014). Land education: Indigenous, post-colonial, and decolonizing perspectives on place and environmental education research. *Environmental Education Research*, 20(1), 1–23. <https://doi.org/10.1080/13504622.2013.877708>
- Voyles, T. B. (2015). *Wastelanding: Legacies of uranium mining in Navajo country*. University of Minnesota Press.
- Warren, T. M. (2016). *Understanding the perceptions African Americans have about the environment and nature and how those perceptions influence their behavior and environmental commitment* (Publication No. 10142442) [Doctoral dissertation, Prescott College]. ProQuest Dissertations Publishing.
- Wheaton, M., Kannan, A., & Ardoin, N. M. (2018). *Environmental literacy: Setting the stage* (Environmental Literacy Brief, Volume 1). Stanford, CA: Social Ecology Lab, Stanford University
- Xu, W., & Zammit, K. (2020). Applying thematic analysis to education: A hybrid approach to interpreting data in practitioner research. *International Journal of Qualitative Methods*, 19. <https://doi.org/10.1177/1609406920918810>
- Yacoubian, H. reallyA. (2018). Scientific literacy for democratic decision-making. *International Journal of Science Education*, 40(3), 306-327. <https://doi.org/10.1080/09500693.2017.1420266>
- Yore, L. (2012). Science literacy for all: More than a slogan, logo, or rally flag. In K. Chwee, D. Ran, & M. Kim (Eds.) *Issues and Challenges in Science Education* (pp. 13-24). Springer.
- Zumbo, B. D., Gadermann, A. M., & Zeisser, C. (2007). Ordinal versions of coefficients alpha and theta for Likert rating scales. *Journal of Modern Applied Statistical Methods*, 6(1), 4. 10.22237/jmasm/1177992180



Submitted/PI: Melissa A Collins /Proposal No: 2314075

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>University of California-Berkeley</b>				FOR NSF USE ONLY			
				PROPOSAL NO. <b>2314075</b>	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Melissa Collins</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Melissa Collins - Principal Inv</b>				3.6			36,474
2. <b>Jedda Foreman</b>				2.4			28,772
3. <b>Valeria Romero</b>				3.6			37,501
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.0			0
7. ( 3 ) TOTAL SENIOR PERSONNEL (1 - 6)				9.6			102,747
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.0			0
2. ( 3 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				8.6			61,840
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 1 ) UNDERGRADUATE STUDENTS							1,382
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							165,969
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							60,420
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							226,389
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							105
2. INTERNATIONAL							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 0							0
2. TRAVEL 0							0
3. SUBSISTENCE 0							0
4. OTHER 0							0
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							750
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION							0
3. CONSULTANT SERVICES							27,400
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							43,150
TOTAL OTHER DIRECT COSTS							71,300
H. TOTAL DIRECT COSTS (A THROUGH G)							297,794
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Modified Total Direct Costs (Rate: 60.5, Base:297801)</b>							
TOTAL INDIRECT COSTS (F&A)							180,170
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							477,964
K. FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							477,964
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Melissa Collins</b>				FOR NSF USE ONLY			
ORG. REP. NAME*				INDIRECT COST RATE VERIFICATION			
<b>Eb Thorpe</b>				Date Checked	Date Of Rate Sheet	Initials - ORG	

\*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Submitted/PI: Melissa A Collins /Proposal No: 2314075

# SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION <b>University of California-Berkeley</b>				FOR NSF USE ONLY			
				PROPOSAL NO. <b>2314075</b>	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Melissa Collins</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Melissa Collins - Principal Inv</b>				<b>3.6</b>			<b>37,568</b>
2. <b>Jedda Foreman</b>				<b>2.4</b>			<b>35,303</b>
3. <b>Valeria Romero</b>				<b>3.0</b>			<b>32,188</b>
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				<b>0.0</b>			<b>0</b>
7. ( <b>3</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				<b>9.0</b>			<b>105,059</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				<b>0.0</b>			<b>0</b>
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				<b>10.8</b>			<b>85,871</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>1</b> ) UNDERGRADUATE STUDENTS							<b>1,416</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>192,346</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>69,821</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>262,167</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>4,169</b>
2. INTERNATIONAL							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>0</b>							
2. TRAVEL <b>0</b>							
3. SUBSISTENCE <b>0</b>							
4. OTHER <b>0</b>							
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>2,350</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>25,600</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>30,645</b>
TOTAL OTHER DIRECT COSTS							<b>58,595</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>324,931</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Modified Total Direct Costs (Rate: 60.5, Base:324938)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>196,587</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>521,518</b>
K. FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>521,518</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Melissa Collins</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Eb Thorpe</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

\*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Submitted/PI: Melissa A Collins /Proposal No: 2314075

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>University of California-Berkeley</b>				FOR NSF USE ONLY			
				PROPOSAL NO. <b>2314075</b>	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Melissa Collins</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Melissa Collins - Principal Inv</b>				3.6			42,827
2. <b>Jedda Foreman</b>				2.4			36,362
3. <b>Valeria Romero</b>				2.4			29,356
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.0			0
7. ( <b>3</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				8.4			108,545
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.0			0
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				10.8			90,767
3. ( <b>0</b> ) GRADUATE STUDENTS							0
4. ( <b>1</b> ) UNDERGRADUATE STUDENTS							1,452
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( <b>0</b> ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							200,764
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							72,866
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							273,630
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							27,516
2. INTERNATIONAL							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u>0</u>							0
2. TRAVEL <u>0</u>							0
3. SUBSISTENCE <u>0</u>							0
4. OTHER <u>0</u>							0
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							3,000
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION							0
3. CONSULTANT SERVICES							25,090
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							34,445
TOTAL OTHER DIRECT COSTS							62,535
H. TOTAL DIRECT COSTS (A THROUGH G)							363,681
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Modified Total Direct Costs (Rate: 60.5, Base:363689)</b>							
TOTAL INDIRECT COSTS (F&A)							220,032
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							583,713
K. FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							583,713
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Melissa Collins</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Eb Thorpe</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

\*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Submitted/PI: Melissa A Collins /Proposal No: 2314075

**SUMMARY  
PROPOSAL BUDGET****YEAR 4**

ORGANIZATION <b>University of California-Berkeley</b>				FOR NSF USE ONLY			
				PROPOSAL NO. <b>2314075</b>	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Melissa Collins</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Melissa Collins - Principal Inv</b>				<b>3.6</b>			<b>44,112</b>
2. <b>Jedda Foreman</b>				<b>2.4</b>			<b>37,453</b>
3. <b>Valeria Romero</b>				<b>3.0</b>			<b>37,795</b>
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				<b>0.0</b>			<b>0</b>
7. ( <b>3</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				<b>9.0</b>			<b>119,360</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				<b>0.0</b>			<b>0</b>
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				<b>7.8</b>			<b>66,202</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>1</b> ) UNDERGRADUATE STUDENTS							<b>1,488</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>187,050</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>67,784</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>254,834</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>24,872</b>
2. INTERNATIONAL							<b>0</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>0</b>							<b>0</b>
2. TRAVEL <b>0</b>							<b>0</b>
3. SUBSISTENCE <b>0</b>							<b>0</b>
4. OTHER <b>0</b>							<b>0</b>
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>750</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>28,690</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>43,650</b>
TOTAL OTHER DIRECT COSTS							<b>73,090</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>352,796</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Modified Total Direct Costs (Rate: 60.5, Base:352804)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>213,446</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>566,242</b>
K. FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>566,242</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Melissa Collins</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Eb Thorpe</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

\*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Submitted/PI: Melissa A Collins /Proposal No: 2314075

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>University of California-Berkeley</b>				FOR NSF USE ONLY			
				PROPOSAL NO. <b>2314075</b>	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Melissa Collins</b>				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Melissa Collins - Principal Inv</b>				14.4			160,981
2. <b>Jedda Foreman</b>				9.6			137,890
3. <b>Valeria Romero</b>				12.0			136,840
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)							
7. ( <b>3</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				36.0			435,711
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.0			0
2. ( <b>12</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				38.0			304,680
3. ( <b>0</b> ) GRADUATE STUDENTS							0
4. ( <b>4</b> ) UNDERGRADUATE STUDENTS							5,738
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( <b>0</b> ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							746,129
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							270,891
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							1,017,020
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							56,662
2. INTERNATIONAL							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u>0</u>							0
2. TRAVEL <u>0</u>							0
3. SUBSISTENCE <u>0</u>							0
4. OTHER <u>0</u>							0
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							6,850
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							106,780
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							151,890
TOTAL OTHER DIRECT COSTS							265,520
H. TOTAL DIRECT COSTS (A THROUGH G)							1,339,202
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							810,235
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							2,149,437
K. FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							2,149,437
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Melissa Collins</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Eb Thorpe</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

\*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## Budget Justification

---

The proposed budget goes toward:

### A. *Senior Personnel:*

**PI Melissa Collins, Ph.D.**, will provide overall intellectual, technical, and operational leadership at 30% FTE in Years 1 through 4. Drawing from experience in scale development and quantitative research, Collins's responsibilities will include providing intellectual oversight on construct development, with a focus on scale development; overseeing research design; leading quantitative data collection and analysis; monitoring the budget and project milestones; and disseminating project results, with a focus on academic audiences.

**Co-PI Valeria Romero, M.A.**, will lead project activities as a Research Specialist with an emphasis on equity and participatory methods at 30% FTE in Year 1, 25% FTE in Year 2 and 4, and 20% in Year 3. Romero's responsibilities will include providing intellectual oversight of construct development, with a focus on cultural relevance and equity; overseeing participatory research design; leading qualitative data collection and analysis; and disseminating project results, with a focus on community audiences.

**Co-PI Jedda Foreman, M.B.A.**, will lead project activities as an Environmental Learning Specialist with an emphasis on equity in the outdoor science and environmental learning (OSEL) field at 20% FTE in Years 1 through 4. Foreman's responsibilities will include providing intellectual oversight on construct development, with a focus on relevance for OSEL field; serving as liaison between UCB Berkeley project staff, community partners, the advisory board, and the external evaluator; tracking timelines; and disseminating project results, with a focus on OSEL practitioner audiences.

In accordance with the PAPPG (Chapter II.C.2.g.(i)), the salary compensation requested in the proposal budget for the following senior personnel exceeds two months of salary compensation per year: PI Collins, Co-PI Romero, and Co-PI Foreman. The proposed levels of effort for this project are appropriate for the scope of work and are required in order to fulfill the objectives of the project within the proposed performance period. In addition, these investigators do not hold faculty appointments and are not core funded. Thus, their respective salaries are dependent on extramural funds. These funds will be expended in accordance with NSF and University requirements. For the purposes of determining NSF's 2-month annual effort limit on senior personnel compensation, the University of California, Berkeley defines a "year" as the organization's fiscal year that spans from July 1 to June 30.

### B. *Other Personnel:*

#### B.2 *Other Professionals:*

**Corinne Calhoun**, Environmental Learning Coordinator at the Lawrence Hall of Science, will serve as project coordinator at 30% FTE in Year 1, 35% in Years 2 and 3, and 25% in Year 4.

**Alex Sanchez**, Research Coordinator at the Lawrence Hall of Science, will support data collection, analysis, and dissemination of results at 40% FTE in Years 1 through 3, and 35% in Year 4.

**Tim Hurt**, Computational Thinking Lead at the Lawrence Hall of Science, will support data management, psychometric analysis, and multilevel modeling at 2% FTE in year 1, 15% FTE in years 2 and 3, and 5% FTE in year 4.



**B.4 Undergraduate Student:** An undergraduate student will provide support with research data processing and transcription in years 1–4, estimated at 80 hours/year (3.8% FTE), based on University rates and policies for undergraduate student employees.

*Salaries are based on (9/1/2022) actual salaries and are projected to include an annual cost-of-living adjustment (and merit, if applicable) effective each year.*

**C. *Fringe Benefits:*** The University of California, Berkeley Composite Fringe Benefit Rates (CFBR) have been reviewed and federally approved by the Department of Health and Human Services (DHHS) for use by all fund sources through FY21. Rates beyond June 30, 2021 are estimates and are provided for planning purposes only. Future CFBR rates are subject to review and approval by DHHS on an annual or bi-annual basis. Fringe benefits are assessed as a percentage of the respective employee's salary. The benefit rates are as follows:

CFBR Rate Group	Proposed		Projections for Planning Purposes		
	FY22	FY23	FY24	FY25	FY26
Academic	35.9%	35.4%	35.4%	35.4%	35.4%
Staff	43.8%	42.8%	42.8%	42.8%	42.8%
Students (Graduate and Undergraduate)	2.8%	2.8%	2.3%	2.3%	2.3%

*For more information, please see: <https://spo.berkeley.edu/policy/benefits/benefits.html>*

**E. *Travel:*** Domestic: Cost estimates are based on past similar charges and current prices via ConnexUC, a web portal with access to University of California's Systemwide Travel Program offering comprehensive discounted rates and benefits for all those affiliated with UC. Cost estimates follow the UC Travel Regulations, Policy G-28 (see: <https://policy.ucop.edu/doc/3420365/BFB-G-28>). A travel budget of \$56,662 is requested broken down as follows:

1. \$8,128 is requested for a PI/Co-PI and one community member to attend the AISL PI meeting in Years 2 and 4. The amount includes airfare, meals, lodging, ground transportation (car rental), mileage to/from the airport, and parking. Per university practice, mileage to/from the home airport is based on estimated miles using the institutional mileage reimbursement rate (\$0.655/mile, or approximately \$50 RT) and parking rates at the airport (estimated at \$30/day). Ground transportation (car rental or taxi/Lyft) at the destination is estimated at \$60/day. The estimated breakdown of costs is as follows:

*PI Meeting Travel*

Year	# Trips	# Days/Nights	# People	Airfare per person per trip	Meals per person per day	Lodging per person per night	Ground transportation (car rental) per person per trip	Airport mileage and parking per person per trip	Total
Y2	1	3/3	2	\$650	\$79	\$275	\$180	\$140	\$4,064
Y4	1	3/3	2	\$650	\$79	\$275	\$180	\$140	\$4,064

2. \$41,616 is requested for eight persons to each attend one (1) annual 3-day conference in Years 3 and 4 to disseminate project results. Four people will be UC Berkeley project personnel (three co-PIs plus a research assistant) and 4 will be community partners. We will have individuals attend different major conferences such as the North American Association for Environmental Education, American Educational Research Association, Association for Environmental and Outdoor Education, Justice

Outside, or Children and Nature Network, to ensure that our findings are disseminated to multiple audiences. We estimate that conferences will be held at similar venues as previously held conferences such as Chicago and Phoenix. The amount includes airfare, meals, lodging, ground transportation, mileage and parking, and registration fees. Per university practice, mileage to/from the home airport is based on estimated miles using the institutional mileage reimbursement rate (\$0.655/mile, or approximately \$50 RT) and parking rates at the airport (estimated at \$30/day). Ground transportation (car rental or taxi/Lyft) at the destination is estimated at \$60/day. The estimated breakdown of costs is as follows:

*Conference Travel*

Year	# Trips	# Days/ Nights	# People	Airfare per person per trip	Meals per person per day	Lodging per person per night	Ground transportation (car rental) per person per trip	Airport mileage and parking per person per trip	Reg. Fees per person per trip	Total
Y3	1	4/3	8	\$650	\$79	\$275	\$240	\$170	\$400	\$20,808
Y4	1	4/3	8	\$650	\$79	\$275	\$240	\$170	\$400	\$20,808

3. \$6,603 is requested for three visits to case sites for Tier 2 data collection for 1 member of the research team (PI, Co-PI, project coordinator, or research coordinator) in Year 3. The amount includes airfare, meals/lodging, ground transportation, and mileage/parking. Sites will be located all across the country, so we used SFO to Washington, DC to estimate flights. Per university practice, mileage to/from the home airport is estimated using the institutional mileage reimbursement rate (\$0.655/mile, or \$50 RT) and parking rates at the airport (estimated at \$30/day). Ground transportation (car rental or taxi/Lyft) at the destination is estimated at \$60/day. The estimated breakdown of costs is as follows:

*Case Site Visits*

	# Trips	# Days/ Nights	# People	Airfare per person per trip	Meals per person per day	Lodging per person per night	Ground transportation (car rental) per person per trip	Airport mileage and parking per person per trip	Total
Year 3	3	4/3	1	\$650	\$79	\$275	\$240	\$170	\$6,603

4. \$315 is requested for mileage to drive to data collection at local sites for Phase 1 (Years 1 and 2) and Phase 2 case site (Year 3) data collection. Members of the team will travel from Berkeley, CA to local sites in CA. Using the University of California's institutional mileage rate (\$0.655/mile), the estimated breakdown of costs is as follows: Average 20 miles RT from Berkeley, CA to Richmond, CA @ \$0.655/ml x 1 person x 8 trips per year = \$105 per year in Years 1, 2, and 3.

**G. Other Direct Costs**

**G.1 Materials and supplies** at \$750 in each grant year for supplies (no food) and printing expenses for Community Research Network meetings, advisory council meetings, and data collection.

**G.2 Printing and shipping youth surveys** at \$3,850 total, or \$1,600 in Year 2 and \$2,250 in Year 3. Year 2 (piloting) is calculated as \$800 for printing (10 pages \* 100 surveys \* 16 sites \* \$.05 per page) and \$800 for shipping (\$50 roundtrip shipping per site \* 16 sites). Year 3 is calculated as \$900 for printing (10 pages \* 50 surveys \* 30 sites \* \$.05 per page) and \$1,500 for shipping (\$50 roundtrip shipping per site \* 30 sites). Because of the variability in Wi-Fi and technology access at sites, we anticipate having to ship paper copies to most organizations. These rates are based on similar services used for a recently completed NSF-funded project, BEETLES.

**G.3 Consultant services.**

**a. Research and Data Equity Consultant Services – Andres Lopez, Ph.D. and Mira Mohsini, Ph.D. of Coalition of Communities of Color,** will consult on all aspects of research design and implementation, including community relationship building, research methods, instrument development, and dissemination. In particular, CCC will support the team by contributing their expertise in 1) creating a BIPOC-led research design, including addressing equitable community involvement in the research process, prioritizing common goals, and centering BIPOC voices in question development, data collection, analysis and interpretation, and dissemination; 2) ensuring equitable research strategies, including in methodology, analysis, and dissemination; and 3) ensuring data equity strategies, including survey modernization, disaggregation strategies, and quantitative and qualitative approaches. Services will be provided at \$6,600 in Year 1, \$6,600 in Year 2, \$5,700 in Year 3, and \$9,300 in Year 4, for a total of \$28,200. This amount covers approximately 20 hours of work in Years 1-3 and 31 hours in Year 4 at CCC's consulting rate of \$300/hr.

**b. External Evaluation - Dr. Bernadette Chi,** an independent consultant, will function as an external evaluator for the project to provide formative evaluation, share stakeholder feedback, liaison with project advisors and facilitate regular advisory board meetings, and produce annual progress reports as well as a summative report in Year 4. Dr. Chi brings expertise in research and evaluation of K-12 STEM and civic education. Services will be provided at \$20,800 in Year 1, \$19,000 in Year 2, and \$19,390 per year in Year 3 and Year 4, for a total of \$78,580. This amount covers approximately 100 hours of work in Year 1, 91 hours of work in Year 2, and 83 hours of work per year in Years 3 and 4, at Dr. Chi's consulting rate of \$200/hr.

**G.6 Other:**

**a. Individual payments for partner organization liaisons** for four people at \$4,000 each in Year 1, \$1,500 each in Year 2, \$4,000 each in Year 3, and \$2,500 each in Year 4, for a total of \$48,000. Partner Organization Liaisons will be the primary point of contact for each partner organization supporting coordination with the project team. They will recruit members for the Community Research Network (CRN), support data collection with youth, and contribute to dissemination. This amount covers approximately 20 hours of work per year in Year 1, 10 hours in Year 2, 20 hours in Year 3, and 15 hours in Year 4 at a rate of \$300/hr.

**b. Honoraria** for 8 advisory board members budgeted at \$44,000. These 8 advisors will provide critical feedback and guidance regarding the overall design and development of the various project activities. Advisors are not under contract for consulting or professional services. Seven of the advisors will receive modest honoraria, budgeted at \$1,000 per person per year in all years of the project, to show appreciation for service to the project (total = \$28,000). This amount covers approximately 4-8 hours of work per person per year. One advisor, an expert in QuantCrit, will receive \$4,000 per year (total=\$16,000) to cover their time and expertise through an increased role, including advising on research design, data analysis, and dissemination, estimated at about 20 hours/year.

**c. Research incentives** for a total of \$11,500, including:

1. Focus groups: To demonstrate our valuing of youths' and community members' time and perspectives, we would like to offer \$50 for 60 people participating in 1-hour focus groups (5 youth and/or community members per focus group x 12 focus groups), in Year 1, for a total of \$3,000.
2. Educators to support coglabs with youth in Year 1: Because they will be supporting our data collection and contributing about 5 hours of time, we will demonstrate our gratitude for educators' time by offering \$250 per educator for 8 educators in Year 3, for a total of \$2,000.
3. Youth interviews: To demonstrate our valuing of youths' time and perspectives, we would like to offer \$25 per 45-min interview for each of 20 youth from case site organizations participating in 3 interviews per youth (or \$75 total per youth), in Year 3, for a total of \$1,500.

4. Educator interviews, To demonstrate our valuing of educators' time and perspectives, we would like to offer \$50 to to 8 educators from case site organizations who participate in a 1-hour interview, for a total of \$400 in Year 3;
5. Educators to administer youth surveys: Because they will be supporting our data collection and contributing about 2 hours of time, we will demonstrate our gratitude for educators' time by offering \$100 per educator for 16 educators in Year 2 (\$1,600) and 30 educators, in Year 3 (\$3,000) for a total of \$4,600.

d. **Translation services** for translating project documents, including consent forms, data collection instruments, and dissemination products, at \$1000 in Years 1 and 2, \$1,500 in Year 3, and \$2,000 in Year 4, for \$5,500 total. Based on prior work with diverse populations, we anticipate needing to translate documents into a number of languages, including Spanish, Chinese, Arabic, and others. These estimates are based on similar services used for ongoing NSF-funded projects led by two of the Co-PIs, using rates quoted for that project (approximately \$0.20 per word), estimating 1000 words into 5 languages in Year 1 and 2, 1500 words into 5 languages in Year 3, and 2,000 words into 5 languages in Year 4.

e. **Transcription services** of audio recordings, estimated at \$150/year all years for a total of \$600. These estimates are based on annual subscription rates for similar services (e.g., Descript) used for ongoing NSF-funded projects led by two of the Co-PIs.

f. **mPlus software** for multilevel modeling at \$895 per year in Year 2 and 3 for a total of \$1790

g. **Open access journal fees** of \$2,500 to publish 2 articles in open access journals (estimated at \$1,000-1,500 per journal) in Year 4

h. **Individual Payments for Community Research Network (CRN;** estimated 6-8 hours per year) at \$500 each for 20 people in Years 1, 2, and 4; for a subtotal of \$30,000; plus, an additional \$2000 for 4 people in Year 4 to engage in co-authoring research dissemination products (estimated 24 hours of work), for a subtotal of \$8,000, and a grand total of \$38,000. The CRN will play an essential role in centering community perspectives in construct development, survey design, recruitment, data collection, and dissemination.

- I. **Indirect Costs:** Indirect Costs are requested at \$810,217. Indirect costs are based on University negotiated rates with the Department of Health and Human Services and are applied at the Research, on campus rate as follows:

	7/1/2021 through 6/30/2022	7/1/2022 until amended
<b>Research, On-campus</b>	<b>60.5%</b>	<b>60.5%</b>

Indirect costs are calculated using the modified total direct cost (MDTC) formula as per the approved rate agreement dated June 25, 2020. Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials, supplies, services, travel and up to the first \$25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships, participant support costs and the portion of each subaward in excess of \$25,000. For more information, please see: <https://spo.berkeley.edu/policy/fa.html>. The rates after July 1, 2022 are provisional and subject to change based upon our updated federally negotiated indirect cost rate agreement.

*Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes*

Submitted to the National Science Foundation (NSF), solicitation NSF 22-626

Submitted by: Melissa Collins, Ph.D. (Principal Investigator), Valeria Romero, M.A. (Co-Principal Investigator), and Jedda Foreman, M.B.A. (Co-Principal Investigator)  
The Lawrence Hall of Science • University of California, Berkeley

#### Facilities, Equipment, and Other Resources

---

**The Lawrence Hall of Science's** (the Lawrence) mission is to inspire and engage through science, discovery and learning in ways that advance equity and opportunity. The Lawrence is the public science center of the University of California, Berkeley, and an innovative leader in the field of science and mathematics education. As a national leader in the development of science and mathematics instructional materials, its approaches, programs, and tools are replicated, scaled up, and disseminated nationally in preK-12, college, and informal science education settings. The Lawrence Hall of Science also supports a network of teachers that test new, cutting-edge instructional materials in classrooms nationwide.

The public museum has a total of 30,000 square feet of programmatic spaces. This includes exhibition space, a planetarium/digital dome, an outdoor science park, a state-of-the-art auditorium that seats 275 people, and 10 teaching classrooms and laboratories that provide a venue for learning experiences. The building also has dedicated office space for project staff and volunteers in the building equipped with standard furnishing including networked computers, phones, printers, and high-speed internet connections. In addition, the Lawrence houses several large meeting rooms suitable for Advisory Board and other large group meetings.

The Lawrence Hall of Science employs a cloud-based file server, hosted and managed at the University of California Data Center, that provides all desktops and laptops with reliable shared storage for project information. A dedicated in-house backup facility exists for all project data stored on the cloud server, and backup is also provided by the Data Center. Many of the ongoing projects either have an online presence or deliver a significant amount of content over the Internet, so the technical staff members maintain web servers, web applications, and online file storage services hosted and managed by the University of California Data Center, and its approved commercial partners. The department has a total of 9 terabytes of managed storage. The Berkeley network gateway is connected to both the California educational network and the commodity Internet via redundant links. The museum also works with campus departments and third-party systems to provide an event calendaring system, registration for educational and professional development services, and a networked display control system.

The **Learning Group** at The Lawrence advances four Strategic Initiatives through research, design, development in ways that expand knowledge, affect practice, influence policy, and impact people nationally and globally. These Strategic Initiatives include:

- Advancing Science in K-12 Systems
- Advancing Environmental Learning
- Transforming Science and Society
- Transforming STEM Pathways

The Lawrence Hall of Science's **Advancing Environmental Learning Initiative** is a multidisciplinary team that aims to advance environmental learning in education systems while centering communities bearing the burdens of environmental injustice. In addition to designing, implementing, and studying



learning experiences for youth, the team also offers a variety of outstanding inquiry-based science professional development options that exemplify sound teaching strategies and are researched to address the needs of all learners. The Lawrence Hall of Science connects with over 20,000 teachers annually—regionally, nationally, and even internationally through collaborations with partner sites, publishers, school districts from NYC to LA, and partners as distant as Japan and Jordan. In addition, the Lawrence Hall of Science’s Research Strand is charged with providing evidence and insights to foster high quality, equitable, and innovative science and mathematics learning experiences. This team rigorously investigates and evaluates learning opportunities to inform program refinement and to contribute to generalizable knowledge for field of STEM education.

**Other Resources:**

Our evaluator, Bernadette Chi, has the necessary office space and resources to provide evaluation services.

Our research justice and equity consultants – Mira Mohsini and Andres Lopez from the Coalition of Communities of Color – have the necessary office space and resources to provide contracted services.

Effective 10/04/2021

## NSF BIOGRAPHICAL SKETCH

OMB-3145-0058

NAME: Melissa Collins

POSITION TITLE &amp; INSTITUTION: Senior Research Lead, Lawrence Hall of Science, UC Berkeley

**A. PROFESSIONAL PREPARATION - (see [PAPPG Chapter II.C.2.f.\(i\)\(a\)](#))**

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE (if applicable)	YEAR (YYYY)
Harvard College	Cambridge, MA	Psychology	Bachelor of Arts	2008
Boston College	Chestnut Hill, MA	Applied Developmental & Educational Psychology	Ph.D.	2016

**B. APPOINTMENTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(b\)](#))**

From - To	Position Title, Organization and Location
2022 - Present	Senior Research Lead, Advancing Environmental Learning Initiative, Lawrence Hall of Science; University of California, Berkeley
2020 - 2022	Senior Research Lead, The Research Group, Lawrence Hall of Science; University of California, Berkeley
2016 - 2019	Research Specialist, The Research Group, Lawrence Hall of Science; University of California, Berkeley
2016	Consultant - Summative Data Analysis, The Achievement Network
2015 - 2016	Teaching Fellow/Instructor, Department of Counseling, Developmental & Educational Psychology; Boston College Lynch School of Education
2011 - 2015	Graduate Research Assistant, Department of Counseling, Developmental & Educational Psychology; Boston College Lynch School of Education
2014 - 2015	Math Assessment Assistant, The Achievement Network
2011	Research & Evaluation Coordinator, Jumpstart
2009 - 2011	Research Assistant, Center for Social Development & Education, University of Massachusetts, Boston

BS-1 of 3

**C. PRODUCTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(c\)](#)) Products Most Closely Related to the Proposed Project**

Collins, M. A., Pande, A., Strang, C., Foreman, J., & Dorph, R. (2021). Impacts from COVID-19: Resilient outdoor science programs need support as challenges persist. Policy brief. Lawrence Hall of Science, University of California, Berkeley; California.

[https://www.lawrencehallofscience.org/wp-content/uploads/2022/02/impacts-from-covid-19-osps\\_2-2022.pdf](https://www.lawrencehallofscience.org/wp-content/uploads/2022/02/impacts-from-covid-19-osps_2-2022.pdf)

Collins, M. A., Dorph, R., Foreman, J., Pande, A., Strang, C., & Young, A. (2020). A field at risk:

The impact of COVID-19 on environmental and outdoor science education: Policy brief.

Lawrence Hall of Science, University of California, Berkeley; California.

[https://www.lawrencehallofscience.org/wpcontent/uploads/2021/10/EE\\_A\\_Field\\_at\\_Risk\\_Policy\\_Brief.pdf](https://www.lawrencehallofscience.org/wpcontent/uploads/2021/10/EE_A_Field_at_Risk_Policy_Brief.pdf)

Policy\_Brief.pdf

Romero, V. F., Collins, M., Young, A., Laina, V., Dorph, R., Pande, A., Strang, C., & Foreman, J. (2022).

Improving outdoor science teaching and learning: The implementation of a capacity-building model in outdoor science programs. Berkeley, CA: The Lawrence Hall of Science, University of California, Berkeley.

Collins, M. A., Totino, J., Hartry, A., Pedroso, R., Romero, V., & Nava, R. (2019). Service learning as a lever to support STEM engagement for underrepresented youth. *Journal of Experiential Education*, 43(1), 55-70. doi: 10.1177/1053825919887407

Hurt, T., Greenwald, E., Allan, S., Cannady, M., Krakowski, A., Brodsky, L., Collins, M. A.,

Montgomery, R., & Dorph, R. (in press). The computational thinking for science framework: Operationalizing CT-S for K-12 science education researchers and educators. *International Journal of STEM Education*.

**Other Significant Products, Whether or Not Related to the Proposed Project**

Collins, M. A., & Laski, E. (2019). Digging deeper: Shared deep structures of early literacy and mathematics involve symbolic mapping and relational reasoning. *Early Childhood Research Quarterly*, 46(1), 201-212. doi: 10.1016/j.ecresq.2018.02.008

Coley, R. L., Votruba-Drzal, E., Collins, M. A., & Cook, K. D. (2016). Comparing public, private, and informal preschool programs in a national sample of low-income children. *Early Childhood Research Quarterly*, 36, 91-105. doi:10.1016/j.ecresq.2015.11.002

Collins, M. A., & Laski, E. V. (2015). Preschoolers' strategies for solving visual pattern tasks. *Early Childhood Research Quarterly*, 32, 204-214. doi:10.1016/j.ecresq.2015.04.004

Votruba-Drzal, E., Coley, R. L., Collins, M. A., & Miller, P. (2015). Center-based preschool and school readiness skills of children from immigrant families. *Early Education and Development*, 26, 549-573. doi: 10.1080/10409289.2015.1000220

Coley, R. L., Votruba-Drzal, E., Collins, M. A., & Miller, P. (2014). Selection into early education and care settings: Differences by developmental status. *Early Childhood Research Quarterly*, 29, 319-332. doi:10.1016/j.ecresq.2014.03.006

**D. SYNERGISTIC ACTIVITIES - (see PAPPG Chapter II.C.2.f.(i)(d))**

Cannady, M.A., Montgomery, R., Hurt, T., Collins, M., Allan, S., Brodsky, L., Greenwald, E., Krakowski, A., & Dorph, R. (2022). Technical report: Measuring Computational Thinking for Science (CT-S). Berkeley, CA: Lawrence Hall of Science at University of California, Berkeley. Retrieved from: <https://www.lawrencehallofscience.org/research/>

Webinar: Collins, M. A., Young, A., Pande, A., & Romero, V. (2021, September). The impact of outdoor science programs on youths' dispositions toward science and the environment. Webinar presented to the Better Environmental Education Teaching, Learning, and Expertise Sharing (BEETLES) Network

Invited Speaker (2016, July): Educational psychology: Learning principles from cognitive science. Lecture for Tokyo University of Social Welfare's summer program in collaboration with Harvard University, Cambridge, MA.

Member: North American Association for Environmental Education (2020-Present)

Member: American Educational Research Association (2021, 2012-2013),

BS-3 of 3

Effective 10/04/2021

## NSF BIOGRAPHICAL SKETCH

OMB-3145-0058

NAME: Jedda Foreman

POSITION TITLE &amp; INSTITUTION: Dir.of Environmental Literacy Programs, The Lawrence Hall of Science

**A. PROFESSIONAL PREPARATION - (see [PAPPG Chapter II.C.2.f.\(i\)\(a\)](#))**

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE (if applicable)	YEAR (YYYY)
Carleton College	Northfield, MN	Psychology/Education	B.A.	2008
California College of Arts	San Francisco, CA	Design Strategy	M.B.A.	2015

**B. APPOINTMENTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(b\)](#))**

From - To	Position Title, Organization and Location
2022-present	Initiative Director, Advancing Environmental Learning, The Lawrence Hall of Science, UC Berkeley. Berkeley, CA.
2019–2022	Director of Environmental Literacy Programs, The Lawrence Hall of Science, UC Berkeley. Berkeley, CA.
2017–present	Director, Advancing Equity and Inclusion in Environmental Education, The Lawrence Hall of Science, UC Berkeley. Berkeley, CA.
2015–present	Project Lead, The Lawrence Hall of Science in Partnership with ChangeScale, a collective impact backbone organization in San Francisco, CA.
2012–present	Project Manager, BEETLES: Better Environmental Education, Teaching, Learning & Expertise Sharing (NSF AISL grant #1612512), The Lawrence Hall of Science, UC Berkeley. Berkeley, CA
2011–2012	Program Manager, Quality of Life Foundation, San Francisco, CA.
2009–2019	Program Assistant and Field Instructor, Teton Science Schools, Kelly, WY.
2006–2008	Mentor-Education, Gender and Sexuality Center, Carleton College, Northfield, MN

BS-1 of 3



**C. PRODUCTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(c\)](#)) Products Most Closely Related to the Proposed Project**

Romero, V., Foreman, J., Strang, C., Rodriguez, L., Payan, R., Moore Bailey, K., & Olsen, S. (2022). Racial equity and inclusion in U.S.-based environmental education organizations: A critical examination of priorities and practices in the work environment. *Journal of Outdoor and Environmental Education*.

Foreman, J., Beals, K., Barakos, L., Lygren, E., and Strang, C. (2022). Guide for Outdoor Science Program and Organization Leaders. Lawrence Hall of Science, Berkeley, CA. Accessed at: <http://beetlesproject.org>.

Foreman, J., Strang, C., Rodriguez, L., Payan, R. (2020). Racial Equity in Outdoor Science and Environmental Education: Re-Establishing the Field with Intention. Lawrence Hall of Science, University of California, Berkeley; California.

Hernandez, B., Romero, V., Foreman, J., & Strang, C. (2020). Building Towards an Inclusive Organizational Culture: Insights and Lessons Learned from YES Nature to Neighborhoods: Practice Brief. Lawrence Hall of Science, University of California, Berkeley; California.

Romero, V., Foreman, J., Strang, C., Maybury, C., Pepito, E., & Rocca, C. (2019). Intentional hiring and recruitment through the lens of equity and inclusion: Insights and lessons learned from Crissy Field Center, Golden Gate National Parks Conservancy. Berkeley, CA.

**Other Significant Products, Whether or Not Related to the Proposed Project**

Foreman, J., Mitchel, B., Elkin, T., Pedemonte, S., Strang, C., & Lujan, V. (2021). An Approach to Walking Field Trips. National Outdoor Learning Library, Green Schoolyards America.  
<https://www.greenschoolyards.org/walking-field-trips>.

Collins, M., Pande, A. Strang, C., Foreman, J., & Dorph, R. (2021). Impacts from covid-19: resilient outdoor science programs need support as challenges persist. Lawrence Hall of Science, University of California, Berkeley; California.

Pedemonte, S., Lujan, V., Strang, C., & Foreman, J. (2021). Full In-person Instructional Plans. National Outdoor Learning Library, Green Schoolyards America. <https://www.greenschoolyards.org/in-person-instructional-plans>

Foreman, J., Pedemone, S., Strang, C., Jen, T., Totino, J., Snyder, J., Binding, M., (2021). Environmental Literacy Curriculum Connections. Lawrence Hall of Science, University of California, Berkeley; California.  
<https://lawrencehallofscience.org/curriculum/environmental-literacy-curriculum/>

Romero, V., Foreman, J., Strang, C., Rodriguez, L., Payan, R., & Moore Bailey, K. (2019). Equitable and inclusive work environments in environmental education: Perspectives from the field and implications for organizations. Lawrence Hall of Science, Berkeley, CA. Accessed at: <http://beetlesproject.org>.

**D. SYNERGISTIC ACTIVITIES - (see PAPPG Chapter II.C.2.f.(i)(d))**

- Advisory board member for “Beyond Birds: Using Audubon’s Guided Nature Experiences to Engage 18-25 Year-Olds with STEM and Climate-Science Content” a NSF-supported project of the National Audubon Society
- I am a member of the North American Association of Environmental Education professional association (2015-present)
- Many products listed above in section C are results of the BEETLES project and were developed in conjunction with other educators and scientists. They are in use in hundreds of informal organizations across the county and internationally.

Effective 10/04/2021

## NSF BIOGRAPHICAL SKETCH

OMB-3145-0058

NAME: Valeria Fike Romero

POSITION TITLE &amp; INSTITUTION: Senior Research Lead, Lawrence Hall of Science, UC Berkeley

**A. PROFESSIONAL PREPARATION - (see [PAPPG Chapter II.C.2.f.\(i\)\(a\)](#))**

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE (if applicable)	YEAR (YYYY)
Holy Names University	Oakland	Sociology and Psychology	B.A.	2005
Mills College	Oakland	Educational Leadership	M.A.	2010
UC Davis	Davis	Education	Ph.D.	2024

**B. APPOINTMENTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(b\)](#))**

From - To	Position Title, Organization and Location
2011- Present	Senior Research Lead, Lawrence Hall of Science; University of California, Berkeley, Berkeley, CA
2010-2011	Resident Fellow, Chicana/Latino Student Development Office; University of California, Berkeley, Berkeley, CA
2010	Program Assistant, Division of Student Life; Mills College, Oakland, CA
2007-2009	Higher Education Fellow, The Greenlining Institute, Berkeley, CA
2007-2008	2007 – 2008 Lead Organizer, Students and Families for Tuition Relief Now, Berkeley, CA

BS-1 of 3

**C. PRODUCTS - (see [PAPPG Chapter II.C.2.f\(i\)\(c\)](#)) Products Most Closely Related to the Proposed Project**

Romero, V.F, Foreman, J., Strang, C., Rodriguez, L., Payan, R., Moore-Bailey, K., & Olsen, S. (2022). Racial equity and inclusion in United States of America-based environmental education organizations: A critical examination of priorities and practices in the work environment. *Journal of Outdoor and Environmental Education*, 1-26.

Romero, V. F., Collins, M., Young, A., Laina, V., Dorph, R., Pande, A., Strang, C., & Foreman, J. (2022). *Improving Outdoor Science Teaching and Learning: The Implementation of a Capacity-Building Model in Outdoor Science Programs*. Berkeley, CA: The Lawrence Hall of Science, University of California, Berkeley

Romero, V., Laina, V., Pande, A., Chi, B., & Snow, J.Z., (2021). *BEETLES: An evaluation of a capacity building model to support outdoor science programs*. Berkeley, CA: The Lawrence Hall of Science, University of California, Berkeley.

Gonzalez, J., Arciniega, M., Romero, V., & Pande, A. (2021). *Centering equity and inclusion in cultivating community*. Berkeley, CA: The Lawrence Hall of Science, University of California, Berkeley.  
<http://beetlesproject.org/resources/centering-equity/>

Romero, V., Foreman, J., Strang, C., Maybury, C., Pepito, E., & Rocca, C. (2019). *Intentional hiring and recruitment through the lens of equity and inclusion: Insights and lessons learned from Crissy Field Center, Golden Gate National Parks Conservancy*. Berkeley, CA.

**Other Significant Products, Whether or Not Related to the Proposed Project**

Dorph, R., Romero, V.F., & Cannady, M. (2022). Informal science institution-designed efforts to broaden participation in STEM learning and career pathways. Poster presented at the American Educational Association Annual Conference, 2022, San Diego, CA.

Sanchez, A. & Romero, V.F. (2021). Teacher leadership: A Review of the Literature. Report submitted to the National Geographic Society. Berkeley, CA: The Lawrence Hall of Science, University of California, Berkeley.

Romero, V., Cuff, K., Cannady, M.A., Nava, R. & Dorph, R. (2019). Fostering Environmental Activism through Community-Based Research Investigations. Poster presented at the American Educational Research Association annual meeting, Toronto, Canada.

Trahan, L., Romero, V., & Blinderman, E. (2019). From the classroom to the floor: Applying language supports to new museum contexts. *Journal of Museum Education*, 44(4), 418-426.

Collins, M. A., Totino, J., Hartry, A., Pedroso, R., Romero, V., & Nava, R. (2019). Service learning as a lever to support STEM engagement for underrepresented youth. *Journal of Experiential Education*. 43(1). 55-70.

**D. SYNERGISTIC ACTIVITIES - (see [PAPPG Chapter II.C.2.f\(i\)\(d\)](#))**

- Member: American Educational Research Association
- Peer Reviewer: Science Education
- Peer Reviewer: American Journal of Evaluation
- Co-Chair, Lawrence Hall of Science Equity Leadership Team
- JEDI Strand Lead, Lawrence Hall of Science



---

**Other Personnel Biographical Information**

---

**Data Not Available**

**Effective 10/04/2021 NSF CURRENT AND PENDING SUPPORT****OMB-3145-0058**

---

---

\*PI/co-PI/Senior Personnel Name: Melissa Collins

---

---

**\*Required fields**

**Note:** NSF has provided 15 project/proposal and 10 in-kind contribution entries for users to populate. Please leave any unused entries blank.

**Project/Proposal Section:**

Current and Pending Support includes all resources made available to an individual in support of and/or related to all of his/her research efforts, regardless of whether or not they have monetary value.<sup>[1]</sup> Information must be provided about all current and pending support, including this project, for ongoing projects, and for any proposals currently under consideration from whatever source, irrespective of whether such support is provided through the proposing organization or is provided directly to the individual. This includes, for example, Federal, State, local, foreign, public or private foundations, non-profit organizations, industrial or other commercial organizations, or internal funds allocated toward specific projects. Concurrent submission of a proposal to other organizations will not prejudice its review by NSF, if disclosed.<sup>[2]</sup>

<sup>[1]</sup> If the time commitment or dollar value is not readily ascertainable, reasonable estimates should be provided.

<sup>[2]</sup> The Biological Sciences Directorate exception to this policy is delineated in PAPPG Chapter II.D.2.

**Projects/Proposals**

1.\*Project/Proposal Title : Collaborative Research: Learning probability through AI problem-solving in a Game-based Environment

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2201424

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 07/2022

Project/Proposal End Date (MM/YYYY) (if available) : 06/2025

\*Total Award Amount (including Indirect Costs): \$ 809,155

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2023	1.20	4.	
2. 2024	1.40	5.	
3. 2025	1.40		

\*Overall Objectives : The project aims to use technology-supported learning to improve current practice in high school math education. In this project, we will revisit current practice of high school probability education and design AI problem-solving to connect probability (e.g., independent and conditional probability) and AI (such as Bayesian networks) concepts.

\*Statement of Potential Overlap : No overlap

**Projects/Proposals**

2.\*Project/Proposal Title : Youth Engaged in STEM and Service (YESS)

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 1949586

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2020

Project/Proposal End Date (MM/YYYY) (if available) : 08/2024

\*Total Award Amount (including Indirect Costs): \$ 1,471,693

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2023	2.40	4.	
2. 2024	2.40	5.	
3.			

\*Overall Objectives : This project (YESS) explores the potential for culturally-relevant, STEM-based experiences to support improved STEM attitudes, dispositions, and skills in rising ninth grade youth, with a particular focus on female-identifying and Black and brown youth. We will design, implement, and study two approaches to creating a culturally relevant, solar-based summer programs: one focused on local relevance, and one focused on service learning.

\*Statement of Potential Overlap : No overlap

**Projects/Proposals**

**3.\*Project/Proposal Title :** Natural Hazards Engineering Research Infrastructure: Computational Modeling and Simulation Center 2021-2025

**\*Status of Support :** ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2131111

**\*Source of Support:** UCB Civil and Environmental Engineering/ NSF NHERI

**\*Primary Place of Performance :** University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 10/2021

Project/Proposal End Date (MM/YYYY) (if available) : 09/2025

**\*Total Award Amount (including Indirect Costs): \$** 12,750,000

**\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project**

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2023	0.40	4.	
2. 2024	0.40	5.	
3. 2025	0.40		

**\*Overall Objectives :** To provide a new platform of tools and resources to support numerical simulations in natural hazards engineering (NHE) and to build and support a national network of interdisciplinary researchers and practitioners. The usability evaluation gathers data on the usefulness and impact of SimCenter's tools and resources on the NHE field.

**\*Statement of Potential Overlap :** No overlap



**Projects/Proposals**

4.\*Project/Proposal Title : Math Activation: How does culturally responsive mathematics pedagogy support positive dispositions toward mathematics?

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2300848

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 04/2023

Project/Proposal End Date (MM/YYYY) (if available) : 03/2026

\*Total Award Amount (including Indirect Costs): \$ 1,499,759

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	2.40	4.	
2. 2025	3.00	5.	
3. 2026	3.00		

\*Overall Objectives : This project aims to examine how pedagogical approaches that leverage students' assets may influence students' mathematical perceptions, dispositions, and practices, in turn positioning them for success in learning school mathematics. The project will develop measures of Math Activation and culturally responsive mathematics pedagogy to explore their interaction and encourage asset-based approaches to math instruction.

\*Statement of Potential Overlap : No overlap

**Projects/Proposals**

5.\*Project/Proposal Title : Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes (this proposal)

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 01/2024

Project/Proposal End Date (MM/YYYY) (if available) : 12/2027

\*Total Award Amount (including Indirect Costs): \$ 1,998,911

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	3.00	4. 2027	3.60
2. 2025	3.00	5.	
3. 2026	3.60		

\*Overall Objectives : Using community-driven, participatory methods and approaches, this project will develop conceptual understandings and measures of scientific and environmental literacy that center the voices and experiences of youth of color. In addition, we will use developed measures to examine the impact of outdoor science and environmental education experiences on youth, and in particular aim to understand how youth of color make meaning of their experiences.

\*Statement of Potential Overlap : N/A this proposal

**Projects/Proposals**

6.\*Project/Proposal Title : Advancing Science Teaching and English Language Development through Content and Collaboration

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2300284

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 04/2023

Project/Proposal End Date (MM/YYYY) (if available) : 03/2027

\*Total Award Amount (including Indirect Costs): \$ 2,423,071

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	1.20	4. 2027	1.20
2. 2025	1.20	5.	
3. 2026	1.20		

\*Overall Objectives : This project is focused on designing English Language Development (ELD) instructional units that help elementary teachers support science learning and English language development of their emergent multilingual students (EMLs).

\*Statement of Potential Overlap : No overlap

**Effective 10/04/2021 NSF CURRENT AND PENDING SUPPORT****OMB-3145-0058**

---

\*PI/co-PI/Senior Personnel Name: Foreman, Jedda

---

**\*Required fields**

**Note:** NSF has provided 15 project/proposal and 10 in-kind contribution entries for users to populate. Please leave any unused entries blank.

**Project/Proposal Section:**

Current and Pending Support includes all resources made available to an individual in support of and/or related to all of his/her research efforts, regardless of whether or not they have monetary value.<sup>[1]</sup> Information must be provided about all current and pending support, including this project, for ongoing projects, and for any proposals currently under consideration from whatever source, irrespective of whether such support is provided through the proposing organization or is provided directly to the individual. This includes, for example, Federal, State, local, foreign, public or private foundations, non-profit organizations, industrial or other commercial organizations, or internal funds allocated toward specific projects. Concurrent submission of a proposal to other organizations will not prejudice its review by NSF, if disclosed.<sup>[2]</sup>

<sup>[1]</sup> If the time commitment or dollar value is not readily ascertainable, reasonable estimates should be provided.

<sup>[2]</sup> The Biological Sciences Directorate exception to this policy is delineated in PAPPG Chapter II.D.2.

**Projects/Proposals**

1.\*Project/Proposal Title : Working Toward Equitable Organizations: Building Capacity for Leadership of Color in Outdoor and Environmental Science Education

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2005829

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2020

Project/Proposal End Date (MM/YYYY) (if available) : 08/2023

\*Total Award Amount (including Indirect Costs): \$ 1,999,323

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2021	3.60	4.	
2. 2022	3.60	5.	
3. 2023	3.60		

\*Overall Objectives : Addresses inequities in the outdoor and environmental science education by broadening participation of people of color, including African Americans, Latinx, and Native Americans in the leadership and staff of outdoor science programs (OSP) by supporting the development of vertical leadership teams to create and sustain equitable, inclusive, and culturally relevant workplaces and learning environments, and 2) supporting professionals of color currently working in participating OSPs.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

2.\*Project/Proposal Title : Building Capacity in EE through Subnational Networks

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 21-00589

\*Source of Support: Pisces Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 06/2021

Project/Proposal End Date (MM/YYYY) (if available) : 05/2023

\*Total Award Amount (including Indirect Costs): \$ 206,000

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2022	1.80	4.	
2. 2023	2.40	5.	
3.			

\*Overall Objectives : Addresses the lack of support for current and emerging network leaders in the environmental education field by creating a national backbone network.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.



**Projects/Proposals**

3.\*Project/Proposal Title : Connecting to Nature through Outdoor Science

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 053517

\*Source of Support: Woka Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 06/2022

Project/Proposal End Date (MM/YYYY) (if available) : 05/2024

\*Total Award Amount (including Indirect Costs): \$ 249,216

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2023	0.60	4.	
2. 2024	0.60	5.	
3.			

\*Overall Objectives : Creates learning experiences for the Lawrence Hall of Science's Outdoor Nature Lab. These experiences will be pilot tested for national dissemination to nature centers and other nature destinations that are visited by the general public.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

4.\*Project/Proposal Title : Working Toward Racial Equity:  
Building Capacity to Institutionalize Equity in Outdoor and Environmental  
Science Education

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 01/2024

Project/Proposal End Date (MM/YYYY) (if available) : 12/2028

\*Total Award Amount (including Indirect Costs): \$ 4,549,645

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	3.00	4. 2027	3.00
2. 2025	3.00	5. 2028	3.00
3. 2026	3.00		

\*Overall Objectives : Addresses debilitating racial inequities in the OESE field by increasing the capacity of organizations to build more racially just and equitable work environments through a multi-phase cohort-based professional learning approach as well as the creation of a Racial Equity Transformation Tool Kit.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

5.\*Project/Proposal Title : Advancing Organization Transformation for  
Racial Equity in Environmental Education

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: Spencer Foundation (RPP)

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 08/2023

Project/Proposal End Date (MM/YYYY) (if available) : 07/2026

\*Total Award Amount (including Indirect Costs): \$ 397,899

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	0.60	4.	
2. 2025	0.60	5.	
3. 2026	1.20		

\*Overall Objectives : Conducts a landscape assessment to understand the current state of racial equity and justice within the environmental education (EE) field across the United States.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

6.\*Project/Proposal Title : DTI: Indigenous Mixed Reality Science Experiences (IMRSE): Fostering Cultural and Science Identity through Youth Participatory Design of Mixed Reality Experiences

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2241805

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2023

Project/Proposal End Date (MM/YYYY) (if available) : 08/2026

\*Total Award Amount (including Indirect Costs): \$ 1,292,298

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	1.80	4.	
2. 2025	1.80	5.	
3. 2026	1.80		

\*Overall Objectives : Develops and studies a model that strengthens Indigenous youths' capacity for, and disposition toward STEM pathways through the collaborative design of mixed reality Indigenous science experiences.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

7.\*Project/Proposal Title : Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes (this proposal)

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 01/2024

Project/Proposal End Date (MM/YYYY) (if available) : 12/2027

\*Total Award Amount (including Indirect Costs): \$ 1,998,911

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	2.40	4. 2027	2.40
2. 2025	1.80	5.	
3. 2026	1.80		

\*Overall Objectives : Using community-driven, participatory methods and approaches, this project will develop conceptual understandings and measures of scientific and environmental literacy that center the voices and experiences of youth of color. In addition, we will use developed measures to examine the impact of outdoor science and environmental education experiences on youth, and in particular aim to understand how youth of color make meaning of their experiences.

\*Statement of Potential Overlap : this proposal

Effective 10/04/2021

NSF CURRENT AND PENDING SUPPORT

OMB-3145-0058

---

\*PI/co-PI/Senior Personnel Name: Romero, Valeria Fike

---

**\*Required fields**

**Note:** NSF has provided 15 project/proposal and 10 in-kind contribution entries for users to populate. Please leave any unused entries blank.

**Project/Proposal Section:**

Current and Pending Support includes all resources made available to an individual in support of and/or related to all of his/her research efforts, regardless of whether or not they have monetary value.<sup>[1]</sup> Information must be provided about all current and pending support, including this project, for ongoing projects, and for any proposals currently under consideration from whatever source, irrespective of whether such support is provided through the proposing organization or is provided directly to the individual. This includes, for example, Federal, State, local, foreign, public or private foundations, non-profit organizations, industrial or other commercial organizations, or internal funds allocated toward specific projects. Concurrent submission of a proposal to other organizations will not prejudice its review by NSF, if disclosed.<sup>[2]</sup>

<sup>[1]</sup> If the time commitment or dollar value is not readily ascertainable, reasonable estimates should be provided.

<sup>[2]</sup> The Biological Sciences Directorate exception to this policy is delineated in PAPPG Chapter II.D.2.



**Projects/Proposals**

1.\*Project/Proposal Title : Working Toward Equitable Organizations: Building Capacity for Leadership of Color in Outdoor and Environmental Science Education

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2005829

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2020

Project/Proposal End Date (MM/YYYY) (if available) : 08/2023

\*Total Award Amount (including Indirect Costs): \$ 1,999,323

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2021	3.60	4.	
2. 2022	3.60	5.	
3. 2023	3.60		

\*Overall Objectives : Addresses inequities in the outdoor and environmental science education by broadening participation of people of color, including African Americans, Latinx, and Native Americans in the leadership and staff of outdoor science programs (OSP) by supporting the development of vertical leadership teams to create and sustain equitable, inclusive, and culturally relevant workplaces and learning environments, and 2) supporting professionals of color currently working in participating OSPs.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

2.\*Project/Proposal Title : Youth Engaged in STEM and Service (YESS)

\*Status of Support : ☒ Current ☐ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 1949586

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2020

Project/Proposal End Date (MM/YYYY) (if available) : 08/2024

\*Total Award Amount (including Indirect Costs): \$ 1,471,693

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2021	1.80	4. 2024	1.80
2. 2022	1.80	5.	
3. 2023	1.80		

\*Overall Objectives : Project team is co-designing and implementing two summer camp models that engage youth in project-based learning experiences through the lens of either (1) local relevance or (2) global service learning. The research examines the design, development and implementation of the summer camp models. In addition, the research draws on quasi-experimental mixed methods approach to examine the impact of camp experiences on youth's cognitive and social-emotional outcomes.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

3.\*Project/Proposal Title : Advancing Organization Transformation for  
Racial Equity in Environmental Education

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: Spencer Foundation (RPP)

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 08/2023

Project/Proposal End Date (MM/YYYY) (if available) : 07/2026

\*Total Award Amount (including Indirect Costs): \$ 397,899

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	1.40	4.	
2. 2025	1.40	5.	
3. 2026	1.40		

\*Overall Objectives : Conducts a landscape assessment to understand the current state of racial equity and justice within the environmental education (EE) field across the United States.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

4.\*Project/Proposal Title : Calendar in the Sky: Learning Astronomy from Indigenous Mexican Cultures

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: Institute of Museum and Library Services

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2023

Project/Proposal End Date (MM/YYYY) (if available) : 08/2026

\*Total Award Amount (including Indirect Costs): \$ 1,394,140

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	2.40	4.	
2. 2025	2.40	5.	
3. 2026	2.40		

\*Overall Objectives : Calendar in the Sky will engage local communities in learning about astronomical traditions of Mexican & Central American cultures. We will work with local Mexican & Central American communities to co-design programming in the Planetarium at the Lawrence Hall of Science and in Festivals, outreach events held within community neighborhoods. Project activities will result in a series of learning guides and best practices about how to co-design astronomy-focused museum programming.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

5.\*Project/Proposal Title : DTI: Justice and Equity Centered Online Learning Design: Attending to ethics and collaboration in AI systems learning

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available): 2241576

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 09/2023

Project/Proposal End Date (MM/YYYY) (if available) : 08/2026

\*Total Award Amount (including Indirect Costs): \$ 1,294,766

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	2.40	4.	
2. 2025	2.40	5.	
3. 2026	2.40		

\*Overall Objectives : Design, test, and iteratively revise TechHive:AI, a learning experience for high school aged youth that integrates AI technical learning with ethics principles.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

6.\*Project/Proposal Title : Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes (this proposal)

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 01/2024

Project/Proposal End Date (MM/YYYY) (if available) : 12/2027

\*Total Award Amount (including Indirect Costs): \$ 1,998,891

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	3.00	4. 2027	3.00
2. 2025	2.40	5.	
3. 2026	2.40		

\*Overall Objectives : Using community-driven, participatory methods and approaches, this project will develop conceptual understandings and measures of scientific and environmental literacy that center the voices and experiences of youth of color. In addition, we will use developed measures to examine the impact of outdoor science and environmental education experiences on youth, and in particular aim to understand how youth of color make meaning of their experiences.

\*Statement of Potential Overlap : this proposal



**Projects/Proposals**

7.\*Project/Proposal Title : Working Toward Racial Equity:  
Building Capacity to Institutionalize Equity in Outdoor and Environmental  
Science Education

\*Status of Support : ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

\*Source of Support: National Science Foundation

\*Primary Place of Performance : University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 01/2024

Project/Proposal End Date (MM/YYYY) (if available) : 12/2028

\*Total Award Amount (including Indirect Costs): \$ 4,036,340

\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1. 2024	2.40	4. 2027	2.40
2. 2025	2.40	5. 2028	2.40
3. 2026	2.40		

\*Overall Objectives : Addresses debilitating racial inequities in the OESE field by increasing the capacity of organizations to build more racially just and equitable work environments through a multi-phase cohort-based professional learning approach as well as the creation of a Racial Equity Transformation Tool Kit.

\*Statement of Potential Overlap : There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

**Projects/Proposals**

**8.\*Project/Proposal Title :** Transforming Leadership Structures to Disrupt Systemic Racism by Elevating Staff of Color in Informal Science Education

**\*Status of Support :** ☐ Current ☒ Pending ☐ Submission Planned ☐ Transfer of Support

Proposal/Award Number (if available):

**\*Source of Support:** National Science Foundation

**\*Primary Place of Performance :** University of California, Berkeley

Project/Proposal Start Date (MM/YYYY) (if available) : 07/2023

Project/Proposal End Date (MM/YYYY) (if available) : 06/2028

**\*Total Award Amount (including Indirect Costs):** \$

**\*Person-Month(s) (or Partial Person-Months) Per Year Committed to the Project**

*Year (YYYY)	*Person Months (##.##)	Year (YYYY)	Person Months (##.##)
1.		4.	
2.		5.	
3.			

**\*Overall Objectives :** This project will generate (1) a theoretical understanding of leadership that centers the voices and experiences of staff of color in informal science education, (2) learnings about what it takes to build organizational and individual capacities to examine, discern, and transform racialized systems, and (3) a case study that explores the ways in which a university-affiliated science institution can work to enact racially just notions and structures of leadership that elevates and supports Staff of Color.

**\*Statement of Potential Overlap :** There is no known overlap between this project and the proposed project in terms of scope, budget, or person-months planned.

Table 1

1	Your Name:	Your Organizational Affiliation(s), last 12 mo	Last Active Date
	Collins, Melissa A.	University of California, Berkeley	

Table 2

2	Name:	Type of Relationship	Optional (email, Department)	Last Active Date

Table 3

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G	Laski, Elida	Boston College	elida.laski@bc.edu
T	Vasilyeva, Marina	Boston College	marina.vasilyeva@bc.edu
T	Paez, Mariela	Boston College	mariela.paez@bc.edu

Table 4

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active Date
C	Hartry, Ardice	University of California, Berkeley		
A	Cannady, Matthew	University of California, Berkeley		
A	Dorph, Rena	University of California, Berkeley		
A	Romero, Valeria	University of California, Berkeley		
A	Pande, Aparajita	Northwestern University		
A	Laski, Elida	Boston College		
A	Coley, Rebekah	Boston College		
A	Votruba-Drzal, Elizabeth	University of Pittsburgh		
A	DeMeo Cook, Kyle	Education Development Center		
A	Nava, Rosalinda	University of California, Berkeley		
A	Pedroso, Rosio	Pedroso Consulting, Inc.		
A	Chi, Bernadette	Independent Consultant		
A	Sacco, Kalie	University of California, Berkeley		
A	Miller, Portia	University of Pittsburgh		
A	Totino, Joanna	University of California, Berkeley		
A	Foreman, Jedda	University of California, Berkeley		
A	Young, Aujanee	University of California, Berkeley		

A	Strang, Craig	University of California, Berkeley		
A	Hurt, Tim	University of California, Berkeley		
A	Greenwald, Eric	University of California, Berkeley		
A	Allan, Sara	University of California, Berkeley		
A	Brodsky, Lauren	University of California, Berkeley		
C	Asturias, Harold	University of California, Berkeley		
C	Mayfield-Ingram, Karen	University of California, Berkeley		
C	Ford, Ben	Sonoma State University		
C	Virmani, Rajeev	Sonoma State University		
C	Wang, Ning	University of Southern California		
C	Pynadath, David	University of Southern California		

**Table 5**

5	Name:	Organizational Affiliation	Journal/Collection	Last Active Date

Table 1

1	Your Name:	Your Organizational Affiliation(s), last 12 mo	Last Active Date
	Foreman, Jedda	University of California, Berkeley	

Table 2

2	Name:	Type of Relationship	Optional (email, Department)	Last Active Date
R				

Table 3

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G			
T			

Table 4

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active Date
C	Dorph, Rena	University of California, Berkeley		
A	Strang, Craig	University of California, Berkeley		
C	Lujan, Vanessa	University of California, Berkeley		
A	Olsen, Sarah	University of California, Berkeley		
C	Beals, Kevin	University of California, Berkeley		
A	Romero, Valeria	University of California, Berkeley		
A	Mitchell, Betsy	University of California, Berkeley		
C	Lygren, Emilie	University of California, Berkeley		
C	Pedemonte, Sarah	University of California, Berkeley		
A	Elkin, Terri	Alameda Unified School District		
C	Storksdieck, Martin	Oregon State University		
A	Rodriguez, Laura	Justice Outside		
A	Payan, Rena	Justice Outside		
A	Moore Bailey, Kim	Justice Outside		
C				
C				

Table 5

5	Name:	Organizational Affiliation	Journal/Collection	Last Active Date
---	-------	----------------------------	--------------------	------------------

B	John Quay	University of Melbourne	Journal of Outdoor and Environmental Education	
E	Tonia Gray	Western Sydney University	Journal of Outdoor and Environmental Education	



Table 1

1	Your Name:	Your Organizational Affiliation(s), last 12 mo	Last Active Date
	Romero, Valeria	University of California, Berkeley	

Table 2

2	Name:	Type of Relationship	Optional (email, Department)	Last Active Date
R	Kelly, Greg	Mentor	Pennsylvania State University	
R				
R				
R				

Table 3

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G	Patterson, Alexis	UC Davis	School of Education
G	Quijada, Patricia	UC Davis	School of Education
G	Martinez, Danny C.	UC Davis	School of Education
G	McAfee, Myosha	The Equitect	

Table 4

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active Date
A	Strang, Craig	University of California, Berkeley		
A	Foreman, Jedda	University of California, Berkeley		
A	Rodriguez, Laura	Justice Outside		
A	Collins, Melissa	University of California, Berkeley		
A	Olsen, Sarah	University of California, Berkeley		
A	Grindstaff, Kelly	University of California, Berkeley		
A	Cannady, Matthew	University of California, Berkeley		
C	Chi, Bernadette	Independent Consultant		
C	Dorph, Rena	University of California, Berkeley		
C	Hartry, Ardice	University of California, Berkeley		
C	Voussougi, Shirin	Northwestern University		
A	Young, Aujanee	University of California, Berkeley		
A	Sanchez, Alex	University of California, Berkeley		
C	Koo, Ben	University of California, Berkeley		
C	Mayfield, Karen	University of California, Berkeley		

C	Garibay, Cecila	Garibay Group		
C	Arnold, Michael	Informing Change		
C				
C				
C				

**Table 5**

<b>5</b>	<b>Name:</b>	<b>Organizational Affiliation</b>	<b>Journal/Collection</b>	<b>Last Active Date</b>
B	George Julnes		American Journal of Evaluation	
B	Tonia Gray		International Journal of Environmental Education	
B	Sherry Southerland		Science Education	
B	John Settlage		Science Education	

*Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes*

Submitted to the National Science Foundation (NSF), solicitation NSF 22-626

Submitted by: Melissa Collins, Ph.D. (Principal Investigator), Valeria Romero, M.A. (Co-Principal Investigator), and Jedda Foreman, M.B.A. (Co-Principal Investigator)  
The Lawrence Hall of Science • University of California, Berkeley

Data Management Plan

---

**Data Description.** The proposed project will include human subjects data consisting of (1) audio recordings from semi-structured interviews with key stakeholders (e.g., youth, educators, alumni, family, and/or community members); (2) audio recordings from focus group interviews with key stakeholders; (3) youth survey data, including demographic information, collected either on paper or electronically through an online database; (4) educator survey data, including demographic information, collected either on paper or electronically through an online database; (5) observation notes collected during learning experiences; (6) review of documents, products, meeting notes, and artifacts from Community Research Network discussions; and (7) project related metadata (e.g., interview and observational protocols, syntax for statistical analyses).

**Responsibility.** The principal investigators (PIs) will have overall responsibility for data management and dissemination over the course of the research project and will monitor compliance with the plan. In the case that the PIs leave UC Berkeley, they will take the data with them and implement an analogous data management plan at the transfer institution.

**Data Storage.** All data collected will be stored securely in compliance with the University of California Office for the Protection of Human Subjects. Paper data, including observation notes, interview notes and transcripts will be stored, without names, in a locked cabinet. Electronic data will be encrypted and stored on a password-protected server that is only accessible to members of the research and/or evaluation teams. Human subject consent forms will be stored in a locked file cabinet that is only accessible to members of the research and/or evaluation teams.

**Confidentiality.** Since these data will be from human subjects, approval for human subjects research will be obtained through UC Berkeley's institutional review boards. Whenever possible, data will be collected anonymously. Names will not be used in any study data. When it is necessary to link data over time or across data sources (e.g., youth survey and focal youth interview), to protect subject confidentiality, each subject will be assigned an arbitrary code, which will be included with data instead of names. One file or key that contains the correspondence between subject names and codes will be kept in an encrypted password-controlled file and stored separately from the data. After the completion of data collection, this file will be deleted.

Only members of the project teams, including the PIs, Co-PIs, and Research Assistants, will have access to participants' identities. These personnel must have access to participant names, addresses, and telephone numbers in order to perform their duties (i.e., maintaining follow-up contact with participants). Contact information will be encrypted, password protected, and stored separately from study data. All such staff members will be required to pass the CITI course and have current CITI certification. All data

will be presented in an aggregated format so that no person or school can be identified. To maintain the privacy of the participants, any report of individual responses, such as quotes, will be reported with pseudonyms.

**Data Access and Sharing.** Upon completion of the project, members of the project analysis team will have exclusive access to the data for ten years. During this time, the team will (1) analyze data to address specific aims; and (2) conceptualize, present, write and publish the study findings. If requested, access to the de-identified data will be provided by contacting the PI. Data will, in principle, be available for access and sharing as soon as is reasonably possible, normally not longer than one year after publication. Where possible given desire to maintain confidentiality, anonymized data will be made generally available without requiring an explicit request by a third party through a project associated website. Any data collected by the research team and subsequently shared with the External Evaluator will be deidentified before being shared.

The data acquired and preserved in the context of this proposal will be further governed by the University of California's policies pertaining to intellectual property, record retention, and data management, and constraints imposed by the University of California's IRB. We do not anticipate that significant intellectual property issues involved with these data will arise. Reports or publications resulting from the project will be submitted to NSF and be made available through research conferences and journals. However, in the event that discoveries or inventions are made in direct connection with these data, access to the data will be granted upon request once appropriate invention disclosures and/or provisional patent filings are made.

**Products produced by this project.** The proposed project will result in validated youth outcome measures (such as survey scales), a conceptual framework, and an educator survey available for use by education researchers and OSEL professionals.

**Dissemination of products.** The proposed project will disseminate research findings to education research and outdoor science education and environmental learning (OSEL) audiences, as well as families and community members tied to OSEL programming. Research and OSEL audiences will be reached through multiple channels including journal articles, conferences, websites, and online communities to share what we have developed and lessons learned. The PI team will leverage its existing network of OSEL professionals to ensure wide dissemination. Families and community members related to OSEL programming will be reached through summary reports shared by OSEL partners. Products will also be made available on the Lawrence Hall of Science website and social media accounts, as well as our partner organizations' websites and online community websites, as appropriate. Educational products developed through this grant as well as derivative products will become property of the Regents of the University of California.

## **Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes**

### **Supplementary Documents**

#### **Table of Contents**

- A. List of All Personnel and Institutions Participating in the Project
- B. Letters of Collaboration
  - B1. Consultants
    - i. Bernadette Chi, Ph.D., - (Evaluator)
    - ii. Andres Lopez, Ph.D. (Data Equity) - Coalition of Communities of Color (CCC)
  - B2. Advisors
    - i. Laura Rodriguez, Chief Program Officer, Justice Outside
    - ii. Cathy Jordan, Ph.D., Director of Leadership & Education, Institute on the Environment, University of Minnesota and Consulting Director of Research, Children & Nature Network
    - iii. Marc Stern, Professor, Virginia Tech, Forest Resources and Environmental Conservation
  - B3. Project Collaborators:
    - i. Philip Kilbridge, President and CEO, NatureBridge
    - ii. Eric Aaholm, Executive Director, YES, Nature to Neighborhoods
    - iii. Tish Carr, Director, Wabanaki Youth in Science

**Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through  
Community-Driven Outcomes**

*A proposal submitted to the National Science Foundation (NSF 22-626) Program*

*Submitted by:*

*PI Melissa Collins and Co-PIs: Valeria Fike Romero and Jedda Foreman*

*The Lawrence Hall of Science • University of California, Berkeley*

**List of All Personnel and Institutions Participating in the Project**

1. Melissa Collins; Lawrence Hall of Science, University of California, Berkeley; PI
2. Valeria Fike Romero; Lawrence Hall of Science, University of California, Berkeley; co-PI
3. Jedda Foreman; Lawrence Hall of Science, University of California, Berkeley; co-PI
4. Alex Sanchez; Lawrence Hall of Science, University of California, Berkeley; Research Coordinator
5. Corinne Calhoun; Lawrence Hall of Science, University of California, Berkeley; Project Coordinator
6. Craig Strang; Lawrence Hall of Science, University of California, Berkeley; Environmental Learning Expert
7. Tim Hurt; Lawrence Hall of Science, University of California, Berkeley; Data Analyst
8. Bernadette Chi; Chi Evaluation; Evaluator
9. Andres Lopez; Coalition of Communities of Color; Research and Data Justice Consultant
10. Mira Mohsinil; Coalition of Communities of Color; Research and Data Justice Consultant
11. Laura Rodriguez; Justice Outside; Advisor
12. Marc J. Stern; Virginia Tech, College of Natural Resources and Environment; Advisor
13. Cathy Jordan; Children and Nature Network; Advisor
14. Eric Aaholm; YES Nature to Neighborhoods; Partner
15. Blanca Hernandez; YES Nature to Neighborhoods; Partner
16. Tish Carr; University of Maine, Wabanaki Youth in Science; Partner
17. Phillip Kilbridge, NatureBridge, Partner
18. Miho Aida, NatureBridge, Partner

**BERNADETTE CHI, PH.D.**

**CONSULTANT**

1463 Mountain Boulevard, Oakland, CA 94611

bchiconsulting@gmail.com

510-693-6981

December 9, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

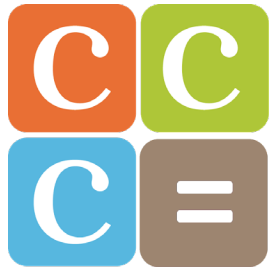
RE: Letter of Commitment

If the proposal submitted by Dr. Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Experiences Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment and Other Resources section of the proposal.

Sincerely,

A handwritten signature in black ink, appearing to read "Bernadette Chi", followed by a period.

Bernadette Chi, PhD  
Independent Consultant



# Coalition of Communities of Color

13 December 2022

Andres Lopez, PhD  
Research Director  
Coalition of Communities of Color  
221 NW 2nd Ave., Ste 303  
Portland, OR 97209

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate as detailed in the Project Description.

The Research Justice Institute (RJI) is the research arm of the Coalition of Communities of Color (CCC) in Portland, Oregon. Formed in 2001, the CCC is an alliance of culturally-specific community based organizations with representation from the following communities of color: African, African American, Asian, Latino, Middle Eastern and North African, Native American, Pacific Islander, and immigrant and refugee populations. The CCC supports a collective racial justice effort to improve outcomes for communities of color through policy analysis and advocacy, environmental justice, culturally-appropriate data and research, and leadership development in communities of color.

The RJI works towards research and data justice by conducting research that defers to BIPOC communities, elevates the everyday knowledge and strategies of BIPOC communities as data, and bridges the divide between community and dominant institutions through the power and uses of community data. The RJI conducts various community-led research projects, provides expert consultation to public and private institutions, and builds the research and data capacity of member and non-member organizations.

Andres Lopez, PhD

A handwritten signature in black ink, appearing to read 'Andres Lopez', is written over a light gray horizontal line.





December 12, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate as an advisor.

I understand that the purpose of the Advisory Board is to provide an external review of key project instruments. As a member of the Advisory Board, I will participate in yearly meetings, as well as periodic reviews of research, design concepts, and content materials.

Regarding my qualification to serve as an advisor, I am the Chief Program Officer for Justice Outside, and have been with the organization for eight years. Within that time, I have supported and collaborated with dozens of non-profit organizations within the outdoor science and environmental education fields with their equity, inclusion, and justice initiatives. I have additionally served as project lead within our partnerships with the Lawrence Hall of Science for over five years.

Sincerely,



Laura Rodriguez,  
Chief Program Officer

1624 Franklin St Suite 520  
Oakland, CA 94612  
[info@justiceoutside.org](mailto:info@justiceoutside.org)

T 510.839.0731  
F 510.839.0651  
[justiceoutside.org](http://justiceoutside.org)

# UNIVERSITY OF MINNESOTA

---

*Institute on the Environment*

325 LES Bldg  
1954 Buford Avenue  
St. Paul, MN 55108  
612-626-9553

December 7, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate as an advisor.

I understand that the purpose of the Advisory Board is to provide an external review of key project instruments. As a member of the Advisory Board, I will participate in yearly meetings, as well as periodic reviews of research, design concepts, and content materials.

Regarding my qualification to serve as an advisor, in addition to my role as the Director for Leadership Development & Sustainability Education at the University of Minnesota's Institute on the Environment, I serve as the Consulting Director of Research for the Children & Nature Network. I have previous NSF funding to study the impact of outdoor science learning. I am well-versed with the literature on nature-based learning and environmental education, have practical experience with outdoor science learning, and with community engagement and participatory processes.

*Cathy Jordan*

Cathy Jordan, PhD  
Director of Leadership & Education, Institute on the Environment  
Consulting Director of Research, Children & Nature Network  
[Jorda003@umn.edu](mailto:Jorda003@umn.edu)  
651-334-3973

INSTITUTE ON THE  
ENVIRONMENT

UNIVERSITY OF MINNESOTA  
Driven to Discover<sup>SM</sup>  
Page 85 of 91



**Forest Resources and  
Environmental Conservation**

310 West Campus Drive  
Blacksburg, Virginia 24061  
P: (540) 231-7418  
mjstern@vt.edu

December 8, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate as an advisor.

I understand that the purpose of the Advisory Board is to provide an external review of key project instruments. As a member of the Advisory Board, I will participate in yearly meetings, as well as periodic reviews of research, design concepts, and content materials.

Regarding my qualification to serve as an advisor, I am an expert in survey research methods and instrument design, particularly within the realm of environmental education and informal science learning, having published over 40 peer-reviewed journal articles specifically within this domain. I have also taught Social Science Research Methods graduate level courses for nearly 20 years.

Sincerely,

A handwritten signature in black ink, appearing to read 'Marc J. Stern'.

Marc J. Stern, Professor



[naturebridge.org](https://naturebridge.org)

December 2, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

If the proposal submitted by Melissa Collins entitled Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes is selected for funding by NSF, it is NatureBridge's intent to collaborate as detailed in the Project Description.

NatureBridge connects over 35,000 students and 700 schools each year to the wonder and science of the natural world, igniting self-discovery and inspiring stewardship of our planet. We operate in Yosemite National Park and the Golden Gate National Recreation Area in California, Olympic National Park in Washington, and Prince William Forest Park in Virginia.

As the largest education partner of the National Park Service, we are proud to support their mission to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education and inspiration of this and future generations.

A handwritten signature in blue ink that reads "Phillip Kilbridge".

Phillip Kilbridge  
President & CEO



November 30, 2022

Melissa Collins  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

To Whom It May Concern:

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is my intent to collaborate as detailed in the Project Description.

In partnership with nature, YES Nature to Neighborhoods (YES) nurtures leaders who champion the wellbeing of our community. YES was founded in 1999 as a summer enrichment program, and quickly expanded to provide wraparound support for youth to attend weeklong nature-based summer camps. Rooted in the belief that profound experiences in nature are a catalyst for individual and community transformation, YES has evolved to provide year-round outdoor and leadership development programming, aligned within a progressive leadership pathways model for underrepresented youth, adults, and families of color.

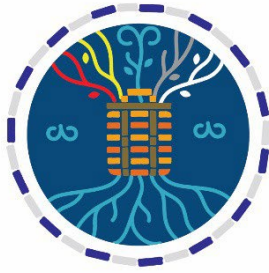
Our 10-year Youth Leadership Pathways model provides youth ages 8-18, and their families, with progressive experiences in both nearby nature and wild places, while providing mentoring, education, and wrap-around support through a cultural and historical lens.

If selected, YES's Executive Director, Eric Aaholm, and Director of Programs & Partnerships, Blanca Hernandez, will serve as lead stewards of the project and serve on the advisory council. Together, Eric and Blanca have over 30 years of experience at YES and have worked on multiple projects with the Lawrence Hall of Science.

Sincerely,

A handwritten signature in black ink, appearing to read "Eric Aaholm", written in a cursive style.

Eric Aaholm  
Executive Director



# WABANAKI YOUTH IN SCIENCE

*Integrating Wabanaki Traditional Cultural Knowledge with Technology and Science*

December 19, 2022

Melissa Collins, Ph.D.  
Lawrence Hall of Science  
University of California  
Berkeley, CA 94720-5200

Dear Dr. Collins,

If the proposal submitted by Melissa Collins entitled *Understanding the Impact of Outdoor Science and Environmental Learning Through Community-Driven Outcomes* is selected for funding by NSF, it is the intent of the Wabanaki Youth in Science (WaYS) to collaborate as detailed in the Project Description.

The Wabanaki Youth in Science (WaYS) program is a grassroots, community-based educational model that started in 2013 with initial financial support from the National Science Foundation's Experimental Program to Stimulate Competitive Research (NSF EPSCoR). The last nine years have seen consistent growth in the involvement of Maine Native youth to persist in science through collaborations with Cultural Knowledge Sharers (CKS) and western science professionals at camps, after-school programs, and internships. Over that time, with the dedicated support from the Wabanaki communities and multiple grants to support WaYS, the program has seen a dramatic increase in the number of students working on long-term natural resource programs within their individual communities. The program has not only opened doors to potential careers in natural resources but taught the value that cultural science brings to the western science perspective.

The hands-on learning is accomplished through a multi-prong approach with one week-long earth camp during the summer, three weekend mini-camps in spring, fall, and winter: after-school programs, and internships. All of these programs incorporate our preferred means of learning by being hands-on, place-based that integrates CKS and western resource professionals in an outdoor learning environment.

Regards,

A handwritten signature in blue ink, appearing to read "Tish Carr", is written over a light blue horizontal line.

tish carr, Ph.D.  
Executive Director

WaYS is a recognized 501(c)(3)

**Page 89 of 91**

---

**List of Suggested Reviewers**

---

**Data Not Available**

**List of Reviewers Not to Include**

---

**Data Not Available**